INSECT REPELLENT IN SCREEN PRINTING INK

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A project submitted in partial fulfilment of the requirements for the

Diploma in Printing Technology

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CERTIFICATE

This is to certify that the project work entitled **"INSECT REPELLENT IN SCREEN PRINTING INK"** is the bonafide work of the following students of Diploma in Printing Technology, SIGA Polytechnic College, Chennai - 600 010, who carried out the project under my guidance and supervision.

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I certify to the best of my knowledge that is project is not part of any other project.

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Submitted for End Semester Practical Examination held on................................

Internal Examiner

External Examiner

FOREWORD

This record is consonance with the curriculum for the Diploma in Printing Technology. The project work was undertaken by us for this beneficial objective.

This record consists of detail description of Characterstics of Screen printing and Insect repellent ink in Screen printing ink using different Substrate

This live experience will be helpful to our career. While doing this project we have learnt to work together as a team recognized each other inside and wisdom.

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Dedicated to.............

SIGA, for its loving guidance and concern for us

SYNOPSIS

INSECT REPELLENT IN SCREEN PRINTING INK

Citronnella oil is one of the important essential oils its obtained from different species of Cymbopogon grasses that grow or are cultivated in tropical regious of Southeast Asia, America, and the Caribbean. Related cymbopogon species are known as lemongrass and are used as herbs to add a lemon flavour to foods. Essential oils are widely used in Soaps, Perfumes, Cosmetics, Aromatherapy and food flavoring.

This work aims to analse the basic ink characteristics of screen printing ink, viz solid ink desity, lab value with the different substrate. Then the effect of mixing different proportion of citronella oil with the ink and analyzing the deviation of the ink charactreristics with respect to the rato mixed will be analyzed. Then on the printed product the scuff value and absorption will also be tested and analyze.

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CHAPTER I

A HISTORY OF PRINTING INK

INTRODUCTION:

An ink is a liquid containing various pigments or dyes used to colouring a Surface to produce an image, text, or design. Ink is used for drawing and/or Writing with a pen, brush or quill. Thicker inks, in paste form, are used extensively in letterpress and lithographic printing. Fluid or viscous material that is transferred from the printing plate to the Paper or other surface, resulting in an impression; printing inks may be of any colour. Pigmented fluid used for writing and drawing, or a viscous compound used for printing, both of various colours but most frequently black. Fluid or paste of various colours (usually black or dark blue) used for writing and printing, composed of a pigment or dye in a liquid vehicle. A dispersion of a pigment or a solution of a dye in a carrier vehicle, yielding a fluid, paste, or powder to be applied to and dried on a substrate, writing, marking, drawing, and printing inks are applied by several methods to paper, metal, plastic, wood, glass, fabric, or other substrate.Early varieties of ink include Indian ink, various natural dyes made from metals, the husk or outer covering of nuts or seeds, and sea creatures like the squid (known as sepia).

India ink is black and originated in Asia. Walnut ink and iron-gall nut ink were made and used by many of the early masters to obtain the golden brown ink used for drawing. Pigmented inks contain other agents to ensure adhesion of the pigment to the surface and prevent its being removed by mechanical abrasion. These materials are typically referred to as resins (in solvent-based inks) or binding agents (in water-based inks). Pigmented inks have the advantage when printing on paper that the pigment stays on the surface of the paper. This is desirable, because when more ink stays on the surface of the paper, less ink needs to be used to create the same intensity of colour.

Dyes, however, are generally much stronger and can produce more colour of a given density per unit of mass. However, because dyes are dissolved in the liquid phase, they have a tendency to soak into paper, thus making the ink less efficient and also potentially allowing for the ink to bleed at the edges, producing unsightly and poor - quality printing. To circumvent this problem, dye-based inks are made with solvents that dry rapidly or are used with quick-drying methods of printing, such as blowing hot air on the fresh print. Other methods to resolve this include harder paper sizing and more specialized paper coatings. The latter is particularly suited to inks that are used in non-industrial settings (and thus must conform to tighter toxicity and emission controls). Such as ink jet printer inks, include coating the paper with a charged coating. Cellulose, the material that paper is made of is also naturally charged, and so a compound that complexes with both the dye and the paper surface aids retention at the surface. Such a compound in common use in ink-jet printing inks is polyvinyl pyrrolidone. An additional advantage of dye-based ink systems is that the dye molecules Interact chemically with other ink ingredients. This means that they can benefit more than pigmented ink from optical brighteners and colour-enhancing agents designed to Increase the intensity and appearance of dyes.

Because dyes get their colour from the Interaction of electrons in their molecules, the way in which the electrons can move is determined by the charge and extent of electron delocalisation in the other ink Ingredients. The colour emerges as a function of the light energy that falls on the dye, Thus, if an optical brightener or colour enhancer absorbs light energy and emits it Through or with the dye, the appearance changes, as the spectrum of light re-emitted to the observer changes. A disadvantage of dye-based inks is that they can be more susceptible to fading, Especially when exposed to ultraviolet radiation as in sunlight.

ORIGIN OF INK:

Throughout history little has been said or written about the influence of ink in Spite of its ancient origin, yet from the moment writing was conceived, so was ink. The story of printing ink began with the invention of the printing process. The earliest evince of printing came from the Far East, centuries after the development of Writing. Records suggest that the Chinese were using hand-curved wooden blocks for Reproduction in AD 251. Writing ink was adapted for the purpose, composed of lamp-Black and gum dissolved in water. The blocks were carved with the design in relief, a Technique of printing which remained unique for the next 1300 years and which became identified as the letterpress proves following the invention of other printing of other Printing processes.Writing at this time was mostly carried out with brushes, though there is some Evidence of the use of quills.

The ink was made up as dry tablets from a mixture of gum and lamp-black. Printing did not reach Europe until the middle ages. The demand for books, religious tracts and the works of poets and witters grew rapidly at this period and copyists were overwhelmed with the demand. The production of sheets of parchment in sufficient quantity to allow printing was very expensive. Over the next 200 years both the quality and availability of paper had increased to such an extent that by the late 14th century it was rapidly replacing parchment for most purpose, except or legal documents. Paper was easily adapted for printing and through the 14"century copies were made more and more by a simple printing technique. It was in 1 5th century that serious experiments began in Eu: JpE which culminated in the work of Gutenberg. Johannes Gutenberg, who was a goldsmith, successfully developed a process of casting metallic type from meticulously prepared moulds producing characters of excellent design and detail.

Once the moulds had been prepared any number of characters could be cast the entir e same high standard. Gutenberg's outstanding achievement was the printing of the 42-line hible in 1456. The quality of the reproduction was highly recognized for the beauty of the type, the lavout of the page and the intense blackness of the print. That the revolution fro written manuscript to be printed book was so successful owes very much to the brilliant craftsmanship of Gutenberg and his assistants.

THE NATURE OF PRINTING INKS:

Printing inks are coloured liquids or pastes, formulated to transfer and reproduce and image from a printing surface. They are used mainly to convey a message, provide protection, but they also can give decorative effect to the substrate to which they are applied. printing inks are used on a wide range of paper s, boards, plastics, and glass and textile surfaces in flat and, in some instances, performed shapes. Lacquers or overprint Vanishes are uncoloured forms of printing inks and can be used to give added gloss and Protective properties to the print and substrate. Printing inks ate applied by five major Printing processes which will be covered later. The film thickness will depend upon the Process used which is usually between 2 and 3 £m. Printing inks consist of dispersions of insoluble colorants or solutions of dyes in a Forms Varnish or vehicles so that the resulting combination a fluid which will distribute and transfer on the printing press. The vehicle must then dry and bind the colorant to the substrate under the press running conditions. Both the colorant and vehicles will Detuning the end behaviour of the printing with respect to the specific resistance Properties.

Visual characteristics of Inks:

The visual characteristics of an ink are recognized in terms of its colour, it intensity, transparency or opacity and gloss, and these properties are largely determined by the quantity and nature of the colorant used specifically related to the vehicle system used.

THE COLOUR OF INK:

Colour is a complex concept and is determined in the following interrelated ways. First, the 'hue' of a colour indicates what kind of colour it is for example, red, blue or green. Secondly, the 'strength' of a colour is measured by its intensity or saturation. The third property is its 'purity' which indicates how bright or dark it is. There are many factors which affect each of these properties to one degree or another. The chemical nature of the colorant has fundamental effect on its hue but so do particle size and shape surface printed ink film. In general, the higher the concentration of a particular colorant the greater the strength of the colour, although, in most cases, an optimum concentration occurs, beyond which there is no further increase in strength. Ink vehicles consist of resins and oils or solvents and these can alter the hue and purity of a particular colorant.

This can be due to the colour of the vehicle itself or because different ink vehicles develop different colours when dispersing the same colorant, owing to wetting or chemical relationship between the vehicles and the colorant. Selected additives to aid dispersion may improve the quality of the colour. The choice of ink vehicle is also important in order to deep the colorant particles apart and well dispersed otherwise, settle ling or flocculation may occur, resulting in loss of strength. For example, the same in an absorbent or non-absorbent paper will show different strengths. Similarly, differences will be seen between inks drying at substantially different rates on the same surface due to different penetration rates. For these reasons it is necessary for an ink maker to take into consideration the substrate when formulating an ink of required shade and colour strength.

The Transparency and opacity of Printing inks:

Printing inks have varying degrees of opacity or transparency depending upon the amount of light which is transmitted through, or reflected from, the surface of the ink. The choice of the colorant and the degree to which it has bun dispersed are major influences of this properly. The more opaque colorants have a greater tendency to reflect and refract light die to the particle size and refractive complex of the colorant. Thus, in the case, for example, of titanium dioxide pigment the high reactive index and particle size effectively reflects and refracts and, therefore, scatters light of all visible wavelengths making it one of the most opaque pigments used in printing inks. The substrate on which the ink is printed will affect the degree to which light is reflected back through the ink film and therefore, will influence the opacity of the print. In this suspect, for example, gloss or matt papers. Transparent film and metallic surfaces will give considerable differences in opacity properties.

The gloss of printing Inks:

The gloss of an ink is a measure of its ability to reflect incident light and depends to a large extent on whether or not the ink forms a smooth film on the surface of the substrate. Generally, the higher the ration of vehicle to colorant the more gloss is obtained. Gloss level can be influenced by the nature of the vehicle itself and its interaction with the colorant which give both effective dispersion and a continuous film when printed. Gloss will also depend upon the substrate printed penetration will reduce gloss as will insufficient wetting or affinity between the ink and the substrate. In addition, higher gloss can be achieved if the adverse effect of the substrate is minimized by the application of thicker films of ink which will improve flow out and surf ace continuity.

Most ink contain significant amount of solvents which are used either to dissolve the resins in the vehicle systems or to adjust the viscosity of the ink for printing requirements. The solvent choice is also important in controlling gloss as it can affect pigment dispersion, hold out, the percentage of resins in the ink at its printing viscosity and the ink-flow characteristics. If the solvent is not, for example, effective in dissolving resins. A poor flowing, less glossy has fundamental effect on its hue but so do particle size and shape surface printed ink film. In general, the higher the concentration of a particular colorant the greater the strength of the colour, although, in most cases, an optimum concentration occurs, beyond which there is no further increase in strength. Ink vehicles consist of resins and oils or solvents and these can alter the hue and purity of a particular colorant.

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CHAPTER II

SCREEN PRINTING INK

INTRODUCTION:

Screen printing is a stencilling process initially described as silk-screen printing or serigraphy. The process has grown considerably in importance during the last few years, particularly in the industrial area. Specific characteristics of the process have made it attractive outside the more established display and poster industries. Screen printing on materials other than textiles began to attract attention on the 1920's, especially as an economic method of producing short-run posters. The process Developed slowly, finding applications mainly in the display and point-of- sale market. The simplicity of the process combined with the thick ink film deposited governed its applications. These characteristics were particularly advantageous in the printing of fluorescent posters, water-slide transfers, display show cards, traffic signs and PVC window stickers.

During 1950's screen printing was found to be a useful printing process for the decoration of polythene bottles and for the production of printed circuits. The growth of the plastics and electronic industries provided new substrates and techniques ideally suited to screen printing. New applications continue to be found for this versatile printing process. Examples of this have been the incredible growth of the membrane touch-switch industry and the printing of rub-removable metallic inks for lottery tickets. As a result , screen printing must be placed alongside the other main processes of lithograhic, letterpress, flexographic, and gravure in its importance.

CHARACTERISTICS OF SCREEN PRINTING INKS:

The characteristics of screen inks become clear when one considers the basics characteristics of the process. The stencil-like image is supported on a fabric mesh stretched across rectangular frame. The ink is forced through the openings in the stencil on to the substrate by drawing it across the mesh with a rubber bladed squeegee.

- First during printing, the ink is held in a printing frame which is open to the atmosphere.
- The solvents must not be so volatile that there is excessive solvent loss during printing.

- The ink solvents must not cause the squeegee rubber to swell or crack, not remove the stencil film.
- The ink must have sufficiently low viscosity to pass easily through the mesh, but not so low as to give slurred printing.
- It is desirable that an ink has excessive flow; shortness is an advantage up to a point since it minimizes the tendency for the ink to string when the screen is pulled off the printed surface.
- Once the ink has been applied to the substrate, it must dry, within a reasonable period, depending on the application of the ink and the drying equipment available.

DRYING METHODS:

- Evaporation
- Oxidation
- Penetration

Evaporation:

Screen printing is almost unique in that, it is possible to employ all available methods of drying. The very nature of the process allows the use of a wide range of solvents and a variety of catalytic-curing resin systems. However, the most important method is evaporation. Most screen inks contain volatile solvents, sometimes representing 70% of the formulation. An interesting point about evaporation-drying screen inks is the wide range of Driers that have been developed in an effort to remove the solvent. These include warm jet-air driers, simple drying racks, frame-driers, hot air blowers, oven driers and microwave driers.

Oxidation:

Oxidation-drying inks are normally based on alkyd resins. Inks for use on decals and metal signs me normally of this type. Catalytic-curing systems are often employed for the more specialized applications of screen printing e, g. polythene bottle printing and printed-circuit production.

Penetration:

Penetration drying is never used as the sole drying method ; due to the heavy ink film, this method if during is impractical. when printing an absorbent MG poster paper, Penetration occurs but it is still essential to rely on solvent evaporation. Certain inks, especially those tor printing PVC, incorporate solvents which penetrate the plastic sheet and promote chemical adhesion.

VISCOSITY/FLOW:

The consistency of screen inks is often described as short and buttery. As discussed earlier, this is advantageous in giving clean, sharp prints. However, it is not always possible to meet this requirement because some inks rely on good flow to achieve a specific effect e. g. Gloss inks for show cards.

- If the screen ink has excessive flow there will be a tendency towards bubbling on printing and slurred prints.
- There will also be a tendency for the paper to stick to the underside of the printing frame although the use of a vacuum printing base minimizes this effect.
- Although lack of flow is desirable, an ink with very poor flow will not flow out once printed to remove the pattern of the mesh from the printed ink film.
- There is no one specific viscosity range which is suitable for all printing conditions. It is normal practice to supply screen inks at a higher viscosity than required; the printer adds solvent according to the nature of the design.
- Average printing viscosity of a screen ink would be 1. 5-2. 0 Pa s but may be much higher.

ADHESION:

The screen process is frequently employed to print on widely differing surfaces, therefore poor adhesion can occur if the correct ink is not selected or the nature of the substrates proves particularly difficult. One of the problems is that the thick ink film is often less flexible than the surface on which it is printed. Poor adhesion will often be the result of this situation. A good example of this is that a good quality polythene bottle ink may be completely unsatisfactory when printed on polythene film. It is not recommended that film of less than 50-75 £m thickness be screen printed.

PVC is widely used as a display material and is the most common flat plastic to be screen printed. Migration of plasticizer from flexible PVC sheet will impair ink adhesion immediately after printing and on storage of the print. Therefore, printing of flexible PVC normally requires inks with a higher proportion of key tone solvent and, due to the variation in PVC sheets ; it is advisable to test the ink adhesion before commencing a printing operation. Due to the inert surface of polythene, even when pre-treated, good ink adhesion is often difficult. Also certain additives in the polythene migrate to the surface and destroy the adhesion The principle is shown in Fig. Because of their simplicity, screens can be produced cheaply and this makes it an attractive process for short-run work. Furthermore, since the image is produced through a screen rather than from a surface the impression pressure is very low. This makes it ideal for printing on fragile boxes or awkward shapes. Irrespective of the type of machine the printing procedure is generally the same. A working supply of ink is placed at one end of the screen and the screen is then raised so that the stock may be fed to register guides or grippers on a base. The screen is then lowered and a rubber or plastic squeegee drawn across the stencil to produce the print.

Ink replenishment is undertaken as necessary. On most flat-bed machines the base to which the substrate is applied is of a vacuum type. This prevents the stock sticking to the screen and being lifted by tacky inks. To a certain extent the thickness of the ink film printed can be controlled by the pressure, sharpness and angle of the squeegee blade. The more upright the blade the thinner the deposit of ink. Thus, in general, fine work requires a more upright blade. However, the type of ink, stock and machine govern the blade setting also.

REQUIREMENT RAW MATERIALS OF INKS:

In common with most inks, screen inks are composed of resins, solvents, pigments and additives. However, many of the requirements ate specific to screen inks.

Resins:

The majority of screen inks that are for printing on paper dry by solvent evaporation. The first requirement is that resins should form a stable solution in acceptable screen solvents. These resins should release the solvents readily to form a tack-free film and give the film adequate flexibility and prevent set-off in the stack. It is advantageous if the resin forms solutions of fairly high viscosity at relatively low solids contents. Inks based on cellulose derivatives can be used without further resin modification but it is possible to add maleic or modified phenolic resins to improve the finish. These resins must be selected to provide good solvent release.

Screen inks for the decoration of flat plastics are almost exclusively based on acrylic or vinyl resins. Acrylic resins have excellent adhesion to a wide range of plastics and have good outdoor durability. Catalytic-curing systems are frequently used for polythene bottle inks. These resins are selected mainly on account of their, good chemical resistance. Resins used in printed circuit inks perform a number of functions. The main requirements are that the resin should adhere to clean copper. It should act as a resist to various chemicals used in the involved processing technique of circuit production and, where necessary, by removed by a solvent or aqueous alkali.

Solvents:

It is possible to use a wide range of solvents in screen inks and virtually all chemical types are employed. The limiting factor is the evaporation rate, as the printing frame is exposed to the atmosphere. Nevertheless, an adequate solvent range is available which, in turn, allows the use of most resin types. The basic requirement of a screen ink solvent is that it provides adequate screen stability and will volatilize with the minimum expenditure of energy. This energy can be at the drying temperature is of significance. It is unlikely that a single solvent will provide the exact balance of screen stability, fast-drying print and cost.

Two or three solvents blends are normal. Propylene glycol ethers are frequently used in mixtures with aromatic or aliphatic hydrocarbons and this has led to the generally accepted term ‘co solvent ink. Attention should be paid to the effect of solvents on both photographic stencils and polyurethane squeegees. Prolonged contact with specific solvents can destroy both stencil and squeegee. Screen printing shops are often not well ventilated therefore health and safety considerations are of paramount importance.

Pigments:

- Which gives the visual identity of an Ink
- It gives color to the Ink
- Gives color to the substrate

Importance Pigmentation of Screen Inks:

- The short soft desirable consistency
- The hue of the ink which is mainly determined by its mass tone
- End-use requirements

The consistency of a screen ink can be controlled by the type and amount of extender calcium carbonate or china clay are frequently used. In addition to controlling the consistency of the ink, the use of extender will lower the cost, which is particularly important for poster inks. The extender will also prevent penetration of the ink into absorbent stocks such as MG poster paper. Screen inks with adequate colour strength can be formulated with as little as 5 % of organic pigment. The mass tone of the ink largely indicates its hue but this is not strictly true with transparent and ultra-thin film inks. It is very difficult to obtain a smooth solid print with completely transparent screen inks. Although these are available for special purposes, such as process inks and car indicator panels, they are not recommended for general-purpose printing. Transparent inks tend to highlight and imperfections in the mesh or squeegee and accentuate any variations in film thickness. Transparent pigments such as phthalocyanine blue and green should be used in conjunction with a small amount of titanium dioxide. The end-use requirement is very important in selecting a suitable pigment. Due to the numerous applications of screen printing, the properties required of a coloured pigment can vary considerably. Much screen printing is for display work and therefore requires good light fastness and weather resistance. Few organic reds are sufficiently lightfast, much use has been made of quinacridone red pigments.

Phthalocyanine pigments are also suitable. Poster inks for outdoor use do not require the same degree of light fastness but fairly good light fastness is still required. As a guide pigments with Blue Wool rating of 5 to 6 are acceptable. When formulating screen inks containing solvents such glycol either, ketone and esters, special regard must be paid to the solvent resistance or the pigment. Where the printed ink film is subjected to certain processes or specific tests, this must be borne in mind when making pigment selection. Pigments with good resistance to bleach will be required when printing polythene bottles to contain bleach. Naphthol red F2R and diarylide yellow are commonly used pigments in polyethene bottle inks.

Additives:

Screen inks require some form of control to avoid the tendency to bubble on printing. This can be achieved by the used of extender but where the use of extender is limited or impossible, and then silicone fluids are frequently used. Silicone of the polymethylsilozane type is normally used in screen inks, usually in quantities less than 1%. However, inks containing silicone are not without problems. In certain circumstances, particularly curing systems, they lack intercoats adhesion or cannot be overprinted with an ink that does not contain silicone. If traces of silicone contaminate certain inks, then pin holding can occur on overprinting, this is most noticeable with metal-printing inks.

- While extenders ate frequently used to control the consistency of screen inks, this can be achieved with structuring additives such as Benton.
- These additives are relatively expensive and can reduce gloss, and care should be taken to select the correct grade according to type of solvent being employed.
- The viscosity of screen inks is sufficiently high that pigment settling rarely occurs but anti settle additives may be required where high specific gravity extenders such as blank fix are used is formulation.
- Wax pastes, such as micronized polyethylene was are added to formulations to promote good rub resistance.

- Driers and anti skinning agents are used with oxidation drying inks. As most oxidation drying screen inks are based on long-oil alkyds, the most commonly used driers are calcium, manganese and cobalt naphthenates. Due to the heavy deposit achieved with alkyd inks, it is important to ensure good through-drying.

PROPERTIES OF SCREEN INKS:

- Their flow is faster than that of offset inks.Their appearance seems thinner.
- Percentage of raw materials are less
- No specific viscosity range suitable for printing.
- Drying methods, Oxidation, Evaporation, Uv methods
- Fast curing. Excellent in hardness, physical & chemical properties.
- Good flexibility, opacity and heat formability.
- Fast curing. Flexibility. Low price.
- Good adhesion to PET. Flexibility.
- Excellent in hardness. Good adhesion & chemical resistance.
- Excellent weathering resistance and flexibility.
- Excellent printability with cylinder press. Fast curing. Abrasion resistance.
- Good adhesion to untreated PET. Fast curing. Low-halogen.
- Flexibility, Good adhesion, Water & alcohol resistance.
- Excellent in hardness & scratch resistance. Fast curing.
- Good high-speed printability. Hardness & scratch resistance.

Ink related problems:

Most problems that occur in screen pr inking are often not directly attributable the ink formulation. Problems occur in misuse or incorrect application of the ink or the final print. Listed below are common problems and suggested solutions based on manipulation of ink formulations.

Adhesion:

As screen printing is such a versatile process it is possible to screen print un a very wide range of surfaces and thus each substrate can present its own ink adhesion problems. When printing on some plastics it is possible to base formulations on resins that bear similarity to the substrate, e. g. Acrylic resins for sheet acrylic, amino resins for melamine formaldehyde mouldings, and vinyl resins for self-adhesive PVC sheet. Resin selection is the most important factor in achieving good adhesion. Indifferent adhesion can sometimes be improved by solvent selection but this is not always reliable. Inadequate flexibility can result in poor ink adhesion ; in this situation modification with plasticizer, or flexibilizing resins will improve matters. In thermosetting systems attention should be paid to the reactive component catalyst, e. g. increasing polyamide content in an epoxypolyamide screen ink will improve flexibility and adhesion.

Bubbling:

This is a very common problem in screen printing. It is usually attributable to long flow or the inability of an ink film to break cleanly between mesh and substrate and may be overcome by the use of silicone defamers, non-silicone defamers, increase extender content, structuring agents or increasing solvency.

Crazing:

This has the appearance of hairline cracks in the print. Normally it only occurs on plastic and is believed to be attributed to shrinkage of the ink film. Crazing can arise due to the ink solvent being withdrawn rapidly from the film. It is most commonly seen when printing on solvent sensitive plastics such as polystyrene or overprinting heavily pigmented inks. Crazing can be eliminated by reducing solvency, lowering pigmentation, correct resin selection or increasing plasticizer content.

Drying:

Inks formulated for display application, I. e. printing of paper, board and self-adhesive plastics, are expected to jet dry rapidly in 20-30 seconds. It is obvious that in these conditions the evaporation rate of the solvent is critical. However, this alone does not govern the speed of drying. Most screen inks require a balance of solvent and diluents to achieve optimum drying. Attention should be paid to solubility parameters and solvent release of various resin systems. Poor solvent releases can 1-esult in blocking and rewetting in the stack.

Inter coat adhesion:

Poor adhesion between ink layers often appears in thermosetting inks, e. g. Epoxy, amino and UV-curing inks. Over curing of the first ink layers is the obvious cause but this sometimes can be overcome by reducing the reactivity of the system.

Feathering:

This appear s as an unsightly spray pattern around the print. Although very often Caused by static electricity charges, it can be attributed to poor in formulation. Feathering can be overcome by increasing extender content, improving solvency, retarding solvent evaporation, inclusion of anti-static agents.

Mesh marking:

A pattern of the mesh appears in the dried ink film. It happens due to poor flow of ink or over pigmentation. It can be over come by increasing resin content.

Pin holing:

Pin holing happens due to high surface tension. It is often caused by silicone contamination but can be eliminated by increasing silicone content. Restricting the ink flow will also assist.

Pick-up:

When over printing screen inks it is possible to re dissolve the first colour down with the over printing colour. The fault shows itself as staining of the mesh, loss of finish and mesh marking. The problem is caused by using a high solvent blend and therefore may be overcome by including diluents or weaker solvents. Also selecting a less soluble grade of resin will assist.

Rub resistance:

Unfortunately to say that many screen inks give some degree of rubbing, this is not unexpected from the heavy ink deposit. It will be found that pigment selection and pigment/binder ration is important. The use of polythene and fluorocarbon waxes will assist with this problem.

Stress cracking:

This occurs when printing on plastics moulded under strain. Contact with ink solvents will release the strains and cause embrittlement and low impact strength. Apart from moulding considerations the problem may be minimized by weakening the solvent mixture or increasing the flexibility of the ink. In the case of printing PVC it is necessary to reduce the ketone and ester solvent content and with polycarbonate and polystyrene reducing the aromatic hydrocarbon content.

CHAPTER III

GENERAL CHARACTERISTIC OF INK

Characteristics of Ink or (Properties)

- Good colour strength
- Light fastness
- Fastness to chemicals
- Resistance to heat
- Fine particle size
- Ability to be dispersed in the vehicle
- Wettability, non-abrasiveness
- Flow properties

The pigment content, depending on the colour tone, is between 5% and approximately 30%. Those organic pigments which give the printing inks (Process inks) the desired colour (hue) are most important for the printing industry. They can be grouped into the two main categories of chromatic (colour) pigments and black pigments.

The main inorganic pigments are;

- White pigment (e.g. titanium dioxide)
- Metal effect pigment (gold and silver bronzes)
- Pearlescent pigment
- Fluorescent pigment (for day light luminous colours)

Printing ink consists of (i) Dyes or pigments or the colouring matter dissolved in a fluid medium, (ii) solvent or vehicle. By this the colour is conveyed to and secured on paper. (iii) drier is used to control the drying time of the ink.

The general properties and essential characteristics demanded of a good printing ink are;

- It shall be capable of being deposited in a thin layer on the printing surface.
- It shall not unduly deform in shape during the transfer to its final position.
- The ink in its final position shall have the correct colour value.
- It shall adhere permanently to the surface on which it is printed.

The ink must print sharply, clearly and give legible print of the desired colour. It must dry sufficiently fast to enable the printed sheet to be handled within a reasonable time. There should be no setoff or smudging. The ink should be economical and print sufficient number of copies sufficient on a per kilograms of ink.

The Stages in The Life of a Printing Ink are:

- Storage
- Distribution
- Impression
- Drying

Nearly all inks set to a solid condition on storage. It is important that the thickening should not go so for as that it cannot be liquefied economically, easily by a mechanical agitator before the ink must be broken down in the first place by very gentle mechanical action of the duct except in rare cases where a mechanical agitator is used. The action of the distributing rollers effects the complete break-down of the ink structure.

The distribution mechanism of the machine involves splitting the ink into finer and finer films. These must still remain transferable from their penultimate position on the printing surface to the paper. The ink must have sufficient tack to allow itself to be split in this way and also to withstand impression without being subject to undue lateral displacement as a result of applied pressure.

Ink Properties:

Properties required of inks:

Many factors influence the printing performance of an ink. To meet all of the required characteristics, an ink must contain pigments, resins and/or varnish, drier, and additives carefully selected by the ink maker. Inks must be suited to the substrate being printed, they must provide the required product resistance, and they must provide all of these properties economically. Of the greatest significance are color and color strength, drying properties, and emulsification properties.

Color Properties:

The color properties of an ink, which depend largely on the pigments, are known as "Masstone," "Undertone," and "tinting strength." Associated with these color properties are transparency or opacity. "Masstone" is the hue or color of a thick film of the ink. It is the color of the bulk ink in the can. It is the color of light reflected by the pigment. "Undertone" is the hue or color of a thin film of the ink. It is the color of light reflected by the paper and transmitted through the ink film. "Tinting strength" is coloring power, or the amount that an ink can be reduced or diluted with a white pigment dispertion to produce a tint of a given density or saturation.

Brilliance and Hue of Pigments:

Pigments vary in brilliance and in hue. Few inorganic pigments - pigments not derived from dyestuffs - have acceptable brilliance. Inorganic pigments are generally low in color strength. Organic pigments are very numerous, quite brilliant, and available in a broad range of hues. Because of their many useful properties, organic pigments are widely used in lithographic inks.

Flow Properties:

A lithographic ink must be sufficiently fluid to travel from one roller to another as it passes from the ink fountain to the plate and the blanket and then to the paper.

Body, consistency, or viscosity:

It is the resistance of a fluid to flow under a force or shear. For practical purposes the ink maker and printer often consider body as combination of ink tack, length, and fludity or viscosity. In the can, ink becomes quite stiff, but when it is worked with a knife (or on the press rollers), it quickly becomes softer and more fluid. The change in viscosity with working is known as shear thinning, or "thixotrophy".

Tack:

Tack is the resistance of a thin film to rapid splitting. It is sometimes estimated by a tap-out test with the finger, usually in comparison with another ink that is to be matched. It can be determined on the tack-measuring instruments. An ink that is not tacky enough may not print clean and sharp. An ink with too much tack will pick and sometimes tear the paper. On a multicolor press, the tack of the ink on each succeeding press unit should be less than on the previous unit so that the last-down ink actually has considerably less tack than the first down ink.

Length:

Length is the ability of an ink to form a string when pulled out by the finger or a spatula. A certain degree of length is necessary to make an ink feed properly to the fountain roller and transfer without piling. Too much length can cause an ink to fly or mist. Both the apparent tack and length of an ink change when it is worked with a knife or on the ink rollers. As fountain solution is emulsified by an ink, the tack and the viscosity of the ink go down. The quantity of the fountain solution fed on the press must be controlled so as not to lower tack excessively. The fountain solution affects not only the vehicle but also the pigment used in a lithographic ink.

Gloss:

Paper is the most important factor in the printing of gloss inks; best results are obtained with high-grade coated and enamel papers. But inks greatly affect the gloss of the print. The resin component, the oil or solvent, and the pigment all affect gloss. Generally, synthetic resins of high molecular weight that do not penetrate into the paper pores provide good holdout, enhancing the gloss.

Emulsification:

The formula for a good working ink may contain twelve to fifteen different ingredients, and it is developed only after many trials and experiments. The principle reason that lithographic inks differ from inks used in other processes is that litho inks must work in contact with water.

Working Properties of Printing Inks:

Body:

This refers to the consistency of inks. Inks are made in a variety of constituents and consistencies. Some are heavy bodied and can be compared with honey. Others are like cream with a light or thin body. Most letterpress and lithographic inks are heavy bodied. Flexographic and photogravure inks are thin bodied. They are called "liquid inks".

Viscosity:

This is related to the term body, viscosity means resistance to flow.

Tack:

This term 'tack' refers to the stickness of inks. In other words it is the force required to split an ink film, between two surfaces. Inks for relief and lithographic processes are prepared for applying to the printing images by a system or prepared for applying inking rollers. Tack is important for the transfer of ink from roller to roller. Then to the printing image and from there to the paper directly to indirectly. Too tacky inks may pick the paper surface whereas inks that have less tack may not print sharply. Tack is also important in ink trapping when over printing is done.

Crystallization:

Crystallation' is a defect caused by the first down ink drying too much and repelling the succeeding colours. If ink has no receptivity, crystallization should not be confused with "Crystallization" in chemistry.

SPECIFICATION FOR ORDERING PRINITNG INKS:

Printing inks are specified after considering one or more of the following factors.

Printing process:

Letterpress, Lithography, Offset, roto-gravure, Screen Printing, die stamping, copper plate printing, etc.

Type of press or printing machines:

Platen, flat bed cylinder, single colour, two, three or multi-colour, sheet fed or web or reel fed.

Type of materials to be printed:

Coated art paper, Writing, newsprint, cellophane, metal foils etc.

Method of drying of Ink:

Air drying, drying by application of heat drying by backing etc.

Kind of finish required:

Gloss, matt, high gloss etc.

End use of the printed item:

Poster, magazine, soap wraps, toffee twist, food package, cement bags, fertilizers, Detergent packs.

Colour required:

Blue, green, red etc.

Is the oriented item to be further processed:

Folding, wire stitching, varnishing, laminating, cutting and creasing, hot foil embossing. An ink that does not flow upto the fountain roller is said, to "back away" causing too little and uneven inking.

Sequence of Printing:

Order of printing various colours in two, three or four colour printing. Process colour inks have to be formulated to suit the sequence of printing the various colours.

APPLICATIONS OF SCREEN PRINTING:

Posters and Graphics Printing in Short Print Runs:

Large-format posters in particular can be produced relatively conveniently in fairly small print runs. The quite thick ink film produces coloring that is very brilliant and resistant even with halftone color impressions.

Traffic Routing Systems and Signs:

Large printing surfaces for high resistance inks are found with traffic signs and routing systems. The requirements they impose are best met using screen printing.

Vehicle Fittings and Instrument Dials:

With vehicle fittings a narrow tolerance range of the translucency of the impression is required in addition to its precision. For example, it must be possible for control lights to light up in precisely defined colors.

Printed Circuit Boards for Electronics:

Due to its simplicity and flexibility, screen printing is an important process during the development of printed circuit boards for electronic circuits. Accurate printing onto copper laminated hard paper or glass-fiber reinforced epoxy board with etching allowance, solder resist, or assembly designations in the necessary coating thickness is only possible in large quantities with screen printing. Restrictions are, however, imposed on the latter as a result of the extreme miniaturization of components and printed circuit boards.

Photovoltaic:

Special conductive pastes are used to print on photo resistors and solar cells, which serve as the contact points for current transfer. In doing so, particular importance is placed on high coating thickness in areas that are, at the same time, extremely small and covered with printed conductors, in order to optimize the efficiency of the energy production with the solar cells as fully as possible.

Compact Discs (CD):

Screen printing is one of the major processes for printing on CDs. Pad printing and more recently even offset printing are also used.

Textiles:

The depth of the ink absorption in textiles calls for a large volume of ink to be supplied and screen printing is the preferable process for applying it. Clothing, canvas shopping bags.

Transfer Images:

Screen printing is frequently used to produce transfer images for ceramic decoration. These images are put together from ceramic pigments for firing. The pigment‟s grain size necessitates the use of a screen mesh that is not too fine. After detachment the images are removed from the base material and placed on the preburned bodies by hand. A recognizable feature of these ceramic products is the thick layer of ink. The images can be placed above or below the glazing.

Decorative Products:

Labels, Wallpapers. Seamless decorations such as textile webs, wallpaper, and other decorative products, as well as labels often require rotary printing combined with reel material. Special machines are designed for this. Rotary screen printing with sheet material is used primarily for higher print runs.

Surface Finishing:

Transparent varnish can also be applied using screen printing technology (for spot varnishing, in particular) to finish the printed product.

Screen Printing on Curved Surfaces:

Almost any body that has an even, convex and concave (to a limited extent) not too structured surface can be printed using screen printing. There are virtually no restrictions with regard to the material of the body to be printed on. Ceramics can be printed directly with screen printing. Ceramic pigment inks can be used for subsequent baking or just a low durability varnish applied to the glazed product. It is not always possible to print directly onto plastic components. Surface treatment, for example involving flame treatment, corona charging, or the application of primer is often necessary to ensure that the ink adheres.

Bottles:

Glass bottles with a baked finish or pretreated plastic bottles for the food and domestic products sector are printed using the screen printing process. Stretching assures even screen tension, which is required for accurate printing production. This, plus the need for timesaving procedures, has led most large shops to use mechanized stretching devices. Screens can be Screens can be stretched manually stretched mechanically.

Machine Stretching:

Most machines used for stretching are either mechanically or pneumaticallycontrolled. In either system, the procedure is basically the same. The screen fabric is cut slightly larger than the frame to allow a series of grippers or stretcher bars to suspend it above and outside the frame edges. The mesh is stretched to a specific tension percentage which is dependent upon the type of fabric and mesh count. A tension meter is a precision instrument used to measure the surface tension of the stretched screen fabric. Obtaining a specific tension level affects print sharpness, register, printing ink density, and stencil life. The tension meter consists of an indicator dial and a spring-loaded measuring bar supported by metal beams. When a tension meter is placed on the screen fabric, the tension meter's measuring bar pushes into the fabric.

MATERIALS USED FOR SCREEN PRINTING FABRICS:

The two basic categories of fabrics commonly used in screen printing are;

- Multifilament
- Monofilament.

Multifilament fabrics:

Multifilament Fabric is made up of many fine strands twisted together to form a single thread. The multifilament threads are woven together to form the screen mesh. Multifilament fabric is gauged by the double-X system. Used for many years for measuring silk bolt cloth, but not based on any real measurement, the double X is preceded by a number denoting mesh count. The higher the number the finer the mesh and the smaller the mesh openings. Multifilament fabrics commonly range from 6XX to 25XX. Most multifilament fabrics used for screen printing applications are either silk or polyester.

Monofilament fabrics:

Monofilament fabrics are constructed of single strands of synthetic fiber woven together to form a porous mesh material. Monofilament fabrics have a smooth surface structure that produces uniform mesh apertures. These fabrics include polyester, nylon, wire mesh, and metalized polyester. Monofilament fibers can be woven finer than multifilament'sand still retain adequate open areas for easy ink passage. Unlike multifilament fibers, monofilament fibers are measured by actual mesh count per.

Nylon Fabric:

Nylon is very much suitable for hosiery and the knitted fabrics because of its smoothness, light weight and high strength. Nylon is a lustrous fibre. The lustre of the fibre can be modified by adding the delustering agent at the molten stage.

Composition:

The nylons are polyamides with recurring amide groups. They contain carbon, oxygen, nitrogen and hydrogen elements.

Strength:

Nylon has good tenacity and the strength is not lost with age. Nylon has a high strength to weight ratio. It is one of the lightest textile fibres is at the same time also one of the strongest. It is one of the fibres which are added at the points of wear such as knees and seats of jeans and toes and heels of socks. The strength of the nylon fabric is lost when wet. Nylon has excellent abrasion resistance.

IMAGE CARRIERS USED FOR SCREEN PRINTING:

Negative and Positive making:

Line and halftone positives are needed to prepare photographic screens. These positives are obtained by photographing line and continuous tone copy. In every printing unit, whether the work is done by hand or by machine, they employ a screen as a means of holding the design to be printed. The screen consists of a wooden frame, metal frame or plastic frame. Metal meshes are used for high precision jobs. The stainless steel mesh is usally fitted in a metal frame with the use of vacuum pressure.

Preparation of a Screen Frame:

The most common frame used is made up of soft, straight, grained, dried soft wood such as white pine or walnut or any other wood which is light in weight and strong. The thickness and width of the sides of the frame varies depending upon the size of the screen.

Attaching the Screen Fabric to the Frame:

The screen fabric may be attached to the wooden frame by means of nails or stapplers to the underside of the screen. Care should be taken so that the threads of the fabric run parallel to the sides.

Metal Screens:

Metal meshes are used when thousands of impressions are to be printed from a screen and for high precision work or where the ink employed is unsuited for fabric screens. Ceramic ink or dye, could destroy synthetic fabrics after a relatively smaller number of impressions. Metal meshes are made of very fine threads of uniform diameter and their strengths are also classified.

SCREEN PRINTING ADVANTAGES:

- Suitable for short runs multi-colour jobs
- Low preparatory costs
- Light colours can be printed satisfactorily on dark materials or deep colours
- Ideally suited for printing showcards, posters and unusual & irregular materials such as heavy gauge metal, plastic, glass, etc
- Lays down the heaviest ink film thickness of all the printing processes, resulting in enhanced results such as very high gloss varnishing and raised printing results when required.

DISADVANTAGES:

- Halftone subjects are limited to coarse screens.
- Although automatic presses are now available, the process is still in the main restricted to short-run work.
- Conventional inks requires some considerable time, plus use of space consuming Uniform racking, to allow the work to dry, leading to the increased use of UV inks.

CHAPTER III

CITRONELLA OIL

INTRODUCTION:

Citronella oil is one of the major essential oils. It has a rose like odour and bitter taste. It is mainly used in the perfumery and cosmetic industry. Citronella oil is a raw material for production of geranial, citronellal, hydroxy-citronellal and other similar high value perfumery bases. It is also widely used as a starting material for various aromatic chemicals used in scented soaps, sprays, deodorants, detergents, polishes, mosquito repellants etc.

Citronella oil is one of the important essential oils it's obtained from different species of Cymbopogon grasses that grow wild or are cultivated in tropical regions of Southeast Asia, South America, and the Caribbean.

The primary species are C. nardus and C. winterianus, which are called citronella grass. Related Cymbopogon species are known as lemongrass and are used as herbs to add a lemony flavor to foods. Other sources of essential oils include citrus peel, such as orange, lemon, and lime; herbs, such as peppermint and lavender; and trees, such as pine, cedar, and eucalyptus. It is also widely used as a starting material for various aromatic chemicals used in scented soaps, sprays, deodorants, detergents, polishes, mosquito repellants etc.

Essential oils are widely used in:

- Soaps,
- Perfumes,
- Cosmetics,
- Aromatherapy,
- Food flavorings.

Citronella oil has been used as a fragrance in personal care products for more than 50 years. It's increasingly being used today as the main ingredient, or one of several essential oil ingredients, in insect-repelling products, including candles, sunscreen, pet collars, food packaging, and clothing.

The terpenes in the oil are thought to block neural pathways in insects such as mosquitoes and to interfere with their movements and metabolism without killing them. Mosquito repellant plants were preferred over chemical mosquito repellents. It was observed that Citronella plants serve as retardant of mosquitos' growth where they were planted and also prevent the incidence of malaria among the residents. Mortality of Mosquitos was found to increase proportionately with in planted Citronella plants.

Markets Potential:

The essential oil industry in India has witnessed a remarkable growth since the early 70's. From a production of around 50 tpa in 1973, the industry has registered a ten-fold increase in production and the current production is about 700 tpa. Citronella oil constitutes over 90% of the production of essential oils in the country. The major customers are the manufacturers of cosmetics and perfumes who are the manufacturers of cosmetics and perfumes who are mainly located in Mumbai, Bangalore, Madras. Procurement of citronella oil is in the hands of four major buyers, namely, Hindustan Lever Limited, Industrial Perfumes, K.V. Aromatics and Gupta & Co. The total purchases of these four buyers was 1200 tonne in 1992, 2000 tonne in 1994 and 3000 tonne in 1996. Thus, in one year period their procurement increased by about 450 tonne per year at an average. The substantial increase in the demand for essential oils is related to the spurt in the growth of consumer industry which in turn is related with the growing purchasing power of the Indian middle class.

The present demand is placed at around 3400 tonne per year. Besides the domestic demand, there is good potential for exports. Though there are no exports at present, the quality of essential oils produced in Assam is reported to be better than that produced in Sri Lanka and Indonesia which are the two major exporters at present. Citronella oil is being produced in the north-eastern states of Assam, Meghalaya, Arunachal Pradesh, Nagaland and Manipur. Considering the incentives offered by the Government for exports, an export demand of 1000 tpa may exist.

Plant capacity:

The capacity of a citronella oil plant depends mainly on the size of the distillation stills which is the main production unit. Plants are available in varying sizes with processing capacities ranging from 500 Kg to 1000 Kg per batch. Annual production envisaged is 6 tpa on the following basis.

Raw Materials:

The chief raw material is Java citronella grass which grows on sandy loamy soil. It has high affinity for moisture but cannot withstand waterlogging conditions. The most favourabale planting period is during the rainy season from April to September though planting during other seasons is also possible with irrigation. Application of fertilizers is necessary for good growth and yield. About six cuttings are possible in a year.

After the harvest, citronella grass is withered in the shade for 24 hours before distillation. The average life of a citronella plantation is about 5 years. Conditions for cultivation of Java citronella is highly favourable in the north-eastern region. Citronella grass is currently grown on a large scale in the following areas. Assam Boko, Rajapara, Boraigaon, Hajo, Dhubri, Mankachar, Golaghat, Oating, Makum, Pengeri, Dibrugarh Arunachal Pradesh.

Location:

If adequate land is available and the soil is sandy with pH content of 6.7 to 7.7, citronella can be grown anywhere in the north-east. The oil distillation plants should logically be located close to the source of citronella grass. For a typical 6 tpa plant, the project cost including margin money for working capital would be Rs. 4.56 lakhs. Unfortunately this effect can take several weeks to manifest it. Even correctly formulated polythene bottle inks will not adhere to poorly pre-treated bottles. This is probably the most common problem with the decoration of polythene bottles. When printing screen inks based on curing systems, excessive stoving must be avoided to obviate poor intercoat adhesion. This applies, of course, not only when a colour is being overprinted. A curing screen ink must not cure so rapidly that it is too hard to accept later colours.

LITRACTURE REVIEW ABOUT CITRONELLA OIL:

Chemical Analysis And Therapeutic Uses Of Citronella Oil From Cymbopogon Winterianus

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Abstract:

Mosquito repellant plants should be of paramount importance in the present day in Africa where there is rising number of mosquito borne illnesses. Alarming increase in the range of mosquitoes in Africa is as a result of deforestation,stagnant waters, artificial containers, non recyclableradial tires,trees holes, water drainage systems, ditches, ponds, lakes, lagoons, marshes, swamps, floodwater sites, dirty environments, industrialized farming/irrigated fields. This paper focuses on the Citronella Mosquito repellent plants, with a special reference to Tubman University environments.

Active Constituents:

The industrial interest in essential oils is due to their application as fragrances in perfumes, as flavour additives in food products or as pharmaceutical products and desirable repellent characteristics against mosquitoes (Katz et al. 2008; Simic et al. 2008; Silva et al. 2011). Citronellal or rhodinal or 3, 7-dimethyloct-6-en-1-al (C10H18O) is a monoterpenoid, responsible for its distinctive lemony scent.

Medicinal activities and Therapeutic uses:

Citronella oil is commonly known for its natural insect repellent properties, although it has many uses in aromatherapy. It can be used as massage oil for aching joints and muscles. The oil can effectively be used in a nebulizing or humidifying diffuser for its insect repellent properties. Traditional use includes treatment of fever, intestinal parasites, digestive and menstrual problems. When mental illness has to be treated, Citronella can be clarifying and balancing. Combining it with Lemon oil can bring even more of a brightening effect to the mind.

As far as therapeutic use of Citronella oil is concerned, most of the activities are confined to mosquito repellent, antiparasitic, nematicidal, antifungal and anti-bacterial agents. Trongtokit et al. (2005) compared the repellent efficiency of 38 essential oils against mosquito bites, including the species Aedes aegypti. Citronella oil has demonstrated good efficacy against 44 mosquitoes in concentrations ranging from 0.05 % to 15 % (w/v) alone or in combination with other natural or commercial insect repellent products (Sakulku et al., 2009 and Fradin, 1998). Olivo et al. (2008) and Shasany et al. (2000) confirmed that this characteristic of the oil is due to the presence of four main components, citronellal, eugenol, geraniol and limonene. Citronella Plants shown below in the picture.

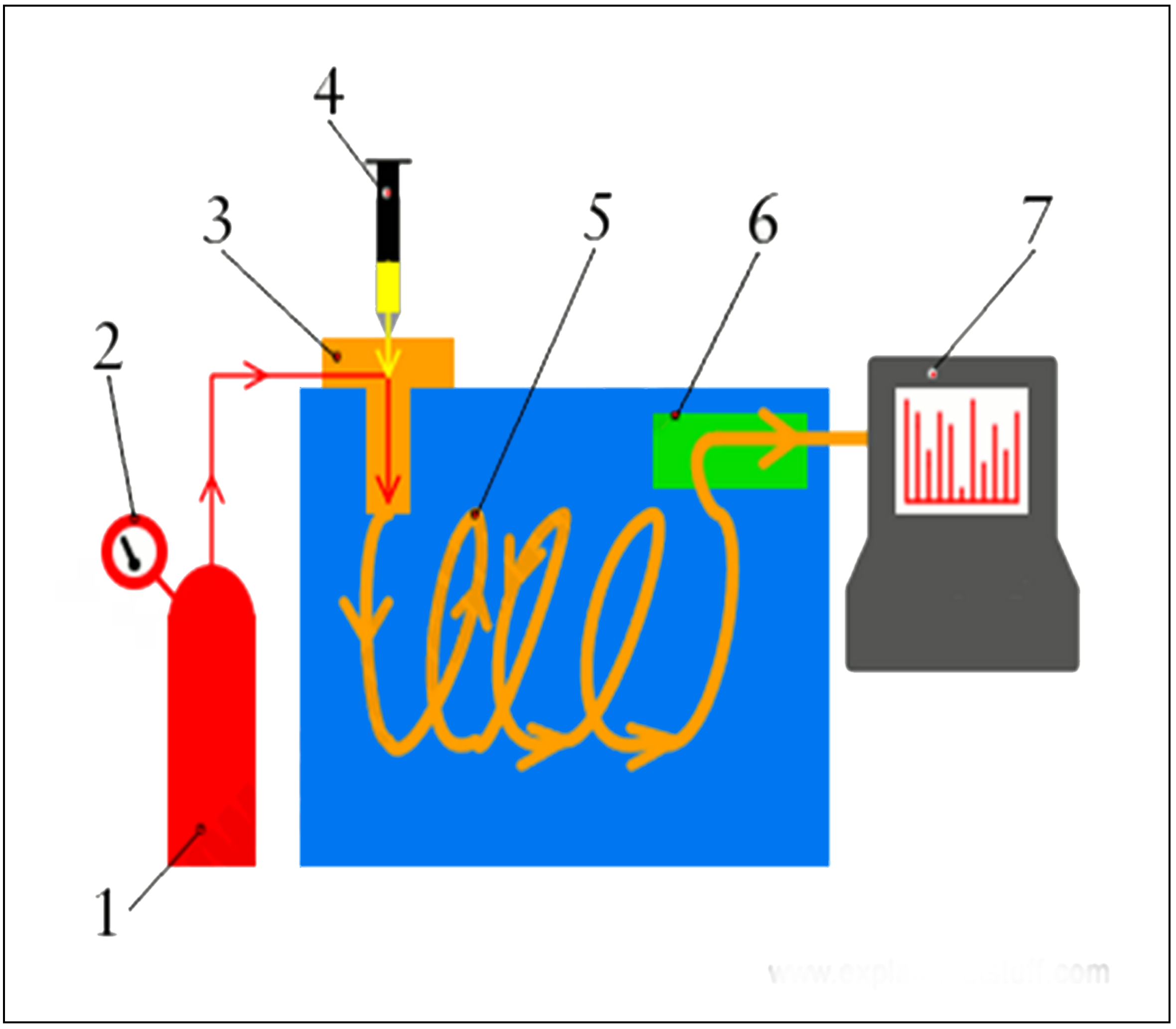
CHROMATOGRAPHIC ANALYSIS:

The chromatographic analysis involves the use of gas chromatography method either alone for qualitative analysis or coupled with mass spectrometry forquantitative analysis.

Gas Chromatography:

Gas chromatography (GC) is a common type of chromatography used in analytical chemistry for separating and analyzing compounds that can be vaporized without decomposition. Typical uses of GC include testing the purity of a particular substance, or separating the different components of a mixture (the relative amounts of such components can also be determined).In some situations, GC may help in identifying a compound.

Construction:



Parts:

- Eluant
- Rate of flow
- Iwnlet Port
- Syringe
- Column

- Detector
- Data analyzer/recorder

Working:

- The eluant (carrier gas) is introduced from a gas cylinder outside the machine. It's called the carrier because that's exactly what it does carry the sample we arestudying through the machine. In gas chromatography, the carrier gas is the mobile phase.
- The rate of flow of the carrier is carefully controlled to give the clearest separation of the components in the sample.
- The carrier enters the machine through an inlet port/splitter.
- The sample being measured is injected into the carrier gas using asyringe and instantly vaporizes (turns into gas form).
- The gases that make up the sample separate out as they move along the column (orange), which is the stationary phase. The column is a very thin (capillary) tube, sometimes as much as 30–60m (100-200ft) long, coiled and entirely contained inside an oven (blue) that keeps it at a high enough temperature to ensure that the sample remains in gas form. The temperature of the oven can be carefully controlled.
- As the sample separates out and its constituent gases travel along the column at different speeds, a detector senses and records them. Various different detectors can be used, including flame ionization detectors, thermal conductivity detectors, and mass spectrometers (usually separate machines).
- The data analyzer/recorder attached to the machine draws a chromatogram (chart with peaks corresponding to the relative amounts of the different chemicals in the sample.

Citral Components:

Identification of the components presents in the chromatogram in

Peak	Components	P (%)	Peak	Components	P (%)
1	Citronellal	98	10	α-morfene	97
2	Citronellol	98	11	δ-cadinene	99
3	Geraniol	95	12	α-cadinene	98
4	eugenol	98	13	elemol	91
5	α-amorfene	98	14	γ-eudesmol	98
6	Germacrene-D	98	15	t-cadinol	90
7	β-selinene	99	16	β-eudesmol	99
8	α-selinene	98	17	α-eudesmol	99
9	α-muuorele	98			

Percentage of Citral content (%) = Individual citral Peak area/total peak area*100

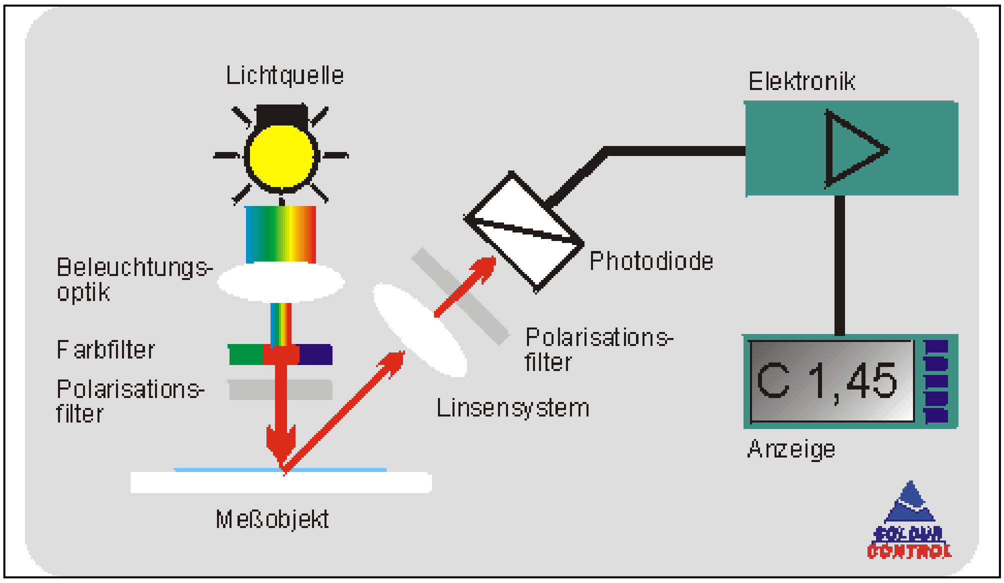
Using the above formula the amount of citral present in the oil is 5.03%. The amount of Citral required for repellency, mentioned by WHO standards is 3-12%. Since the amount of Citral is 5.03% present in this oil, which satisfies the WHO standard for pesticides. Thus it is proved that the oil has mosquito repellency since it satisfies WHO standard.

Conclusion:

The present study suggested that, the important activity of Citronella Plants in our Africa Countries where Malaria is very endemic should be taking serious in order to reduce and break out mosquitoes in our surroundings. The natural mosquito repellents plants are seeing to be the best methods to repel mosquito as compare to chemical methods, non-chemical methods, mechanical methods and synthetic repellents methods. Though each of any of the methods has advantages and disadvantages; but the natural repellents plants are more economical to Africa context.

SOLID INK DENSITY (SID):

Density is the ability of a material to absorb light. Generally, the darker a process color is to the eye, the higher the density. Density measurements of solid ink patches are used to monitor the ink film thickness applied during a press run. In comparing two printed sheets, density readings should be within .05 units, when measured on a densitometer, for meaningful print quality assessment. Dot gain, print contrast and apparent trap are directly affected by this solid ink density.



Generally, these values will vary as the solid ink density changes. Therefore, monitoring solid ink density during a press run is essential when comparing any printed material in terms of quality. There are various publications that list target densities for printing on newsprint stocks. The readings of a solid area, are referred to as solid density. It is measured on a print control strip, which is printed on the sheet at right angles to the print direction. Besides other control elements the print control strip contains solid fields for all four process colours and, if necessary, for additional colours. The solid density value allows a regular ink film thickness to be checked and maintained (within a certain tolerance) throughout the whole sheet width and print-run.

Therefore, for most press operators, the minimum requirement for a color bar is that it contains solid patches of the inks that will be printing since solid ink density is the only thing on press that an operator can adjust while the press is running. Those solid patches are then repeated over the width of the press sheet so that each ink zone is represented by at least one complete set of patches - containing one patch for each color being printed. If the solid density is correct, the contrast value can be used to assess various factors which influence the print result such as;

- Rolling and printing pressure,
- Blankets and underlays,
- Dampening,
- Printing inks and additives.

Since the contrast value, unlike the dot gain, depends to a large extent on the solid density it is not suitable as a variable for standardisation. This is why in the recent past its importance has decreased significantly.

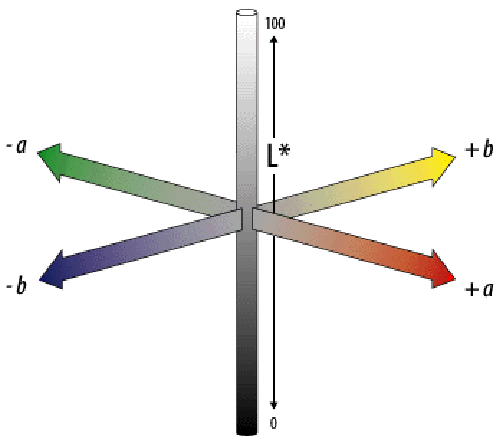
Maximum Ink Coverage:

The amount of ink layered on a page (colors printed on top of each other as in 4- color process printing) is the Total Ink Coverage(TIC) or Total Area Coverage (TAC) for a document. The printing method and type of paper are two key factors in determining the maximum ink coverage that is acceptable. Even if most of your page uses just 100% black text, if there is an area that contains more layers of ink, such as a color photograph, it determines the total ink coverage for that page. If you have overprint areas, that also adds another layering of inks that would increase the amount of ink used for that portion of your layout. ICC profiles contain a great deal of color management information including total ink coverage settings for specific printing conditions. Some desktop publishing software will allow you to set a certain total ink imit and alert you to those areas of a design that exceed that limit. In the illustration on this page, areas of a design that exceed a specified limit (in this case, 300%) are shown in red in an InDesign document.

CIE LAB:

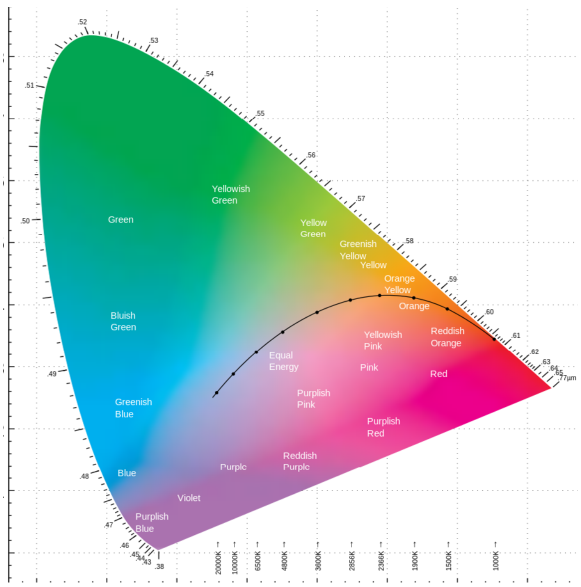
CIE - International Commission of Illumination. This is the organization responsible for setting the world-wide color measurement standards. An organization called CIE (Commission Internationale de l'Eclairage) determined standard values that are used worldwide to measure color. The values used by CIE are called L*, a* and b* and the color measurement method is called CIELAB.

- L* represents the difference between light (where L*=100) and dark (where L*=0).
- a* represents the difference between green (-a*) and red (+a*), and
- b* represents the difference between yellow (+b*) and blue (-b*).



CIE Chromaticity:

Since the human eye has three types of color sensors that respond to different ranges of wavelengths, a full plot of all visible colors is a three-dimensional figure. However, the concept of color can be divided into two parts: brightness and chromaticity. For example, the color white is a bright color, while the color grey is considered to be a less bright version of that same white. In other words, the chromaticity of white and grey are the same while their brightness differs. The CIE XYZ color space was deliberately designed so that the Y parameter was a measure of the brightness or luminance of a color. The chromaticity of a color was then specified by the two derived parameters x and y, two of the three normalized values which are functions of all three tristimulus values X, Y, and Z. These Co-ordinates are used to show the spectrum visible to humans in a Chromaticity Diagram.



They are used to map a device's colour gamut showing the range of colours that can be reproduced against the visible spectrum. In its 1931 recommendation, the CIE adopted the average R, G, and B data for a small number of observers as the experimental definition of the CIE 1931 standard observer. It was considered limportant to eliminate negative numbers among the tristimulus values. Therefore a mathematical transformation of the standard observer data was made, representing a change from the original red, green, and blue primaries to a new set, which cannot be produced by any real lamps, called the X, Y, and Z primaries. The tristimulus values of the equal-power spectrum colors in the CIE X, Y, Z system provide the definition of the 1931 CIE standard observer in its most used form.

Color Difference – Delta E:

The difference between two colour samples is often expressed as Delta E, also called DE, or Δ E. Δ is the Greek letter for 'D'. This can be used in quality control to show whether a printed sample, such as a colour swatch or proof, is in tolerance with a reference sample or industry standard. The difference between the L*, a* and b* values of the reference and sample will be shown as Delta E (Δ E). The resulting Delta E number will show how far apart visually the two samples are in the colour 'sphere'.

Δ E between 0 and 1	In general, this deviation cannot be perceived.
Δ E between 1 and 2	Very small deviation; only perceivable by an experienced eye.
Δ E between 2 and 3.5	Medium deviation; perceivable even by an unexperienced eye.
Δ E between 3.5 and 5	Large deviation
Δ E exceeding 5	Massive deviation

ABSORPTION:

The surfaces of graphical and packaging products are printed and varnished to meet a range of promotional and functional requirements. An essential requirement is that he printed and varnished surfaces must be fully dry to withstand normal conditions of use without marking, scuff- ing, rubbing or smearing. Gluing is used to join paperboard surfaces together, pro- viding permanent shape. Gluing is also used to erect and close cartons and to provide several functions with graphi- cal products. Gluability is therefore an important property. Predictable and reliable interactions between the surface and the inks and adhesives is built into the paperboard by the careful selection of the coating pigments, as well as by the surface sizing system and interlaminar strength.

Printing:

During printing and varnishing the inks and varnishes require fluid mobility to facilitate their transfer from a duct or reservoir via a plate, cylinder or roll, to the surface being printed or varnished. The ink or varnish component which provides fluid mobility is known as the vehicle. Typical vehicles are drying oils which are chemically related to lin- seed oil, organic solvents and water. The choice of vehicle depends on the type of ink or varnish and printing process or other type of application system. If the surface is plastic coated or film laminated, the surface tension might be too low for printing. The surface can then be treated to achieve better printability properties. This can be done by a gas flame or corona treatment.

Absorption And Drying Properties:

Drying is achieved in one of several possible ways de- pending on the type of ink or varnish and the method of application. The fluid vehicle must either be removed or transformed to the solid state.

Drying By Evaporation:

Where the vehicle is composed of organic solvents such as aliphatic alcohols, esters, ketones, toluene, or water, heat can be used to remove the vehicle. Hot air is applied on gravure and flexo presses immediately after each print- ing unit so that solvent removal is virtually instantaneous leaving little scope for any absorption. When organic solvents are used on gravure presses it is necessary to ensure very high levels Screen Printing.

SCUFF RESISTENENCE:

Introduction:

This test is intended to evaluate the rub resistance of prints on paper or board. It can also be used to measure / evaluate color transfer from printed / coated surface during rubbing. Two samples of the same substrate are rubbed against each other in the same plane, under a constant pressure of 2 psi and at a fixed speed of 60 RPM. The numbers of rubs are recorded using a non-contact type digital counter. The most commonly used method to evaluate print quality is by rubbing two printed surfaces against each other.

However if this done manually, the amount of pressure applied during rubbing and number of cycles cannot be tracked. Hence making this method highly operator dependent. The scuff tester overcomes this by rubbing two printed surfaces against each other (face-to- face) in the same plan, at the same speed (60RPM), under a constant rubbing pressure of 2psi. this equipment can also be used to evaluate the color transfer from printed / coated surfaces during rubbing.

CHAPTER IV

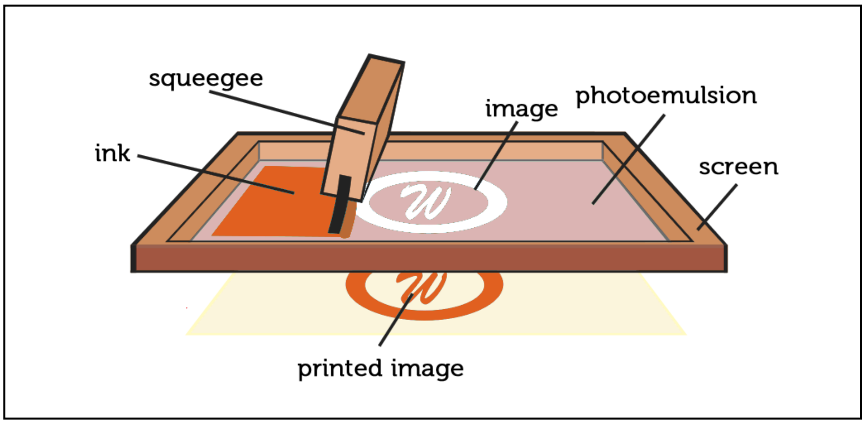
PROJECT WORK FLOW

INTRODUCTION:

- Screen Printing is one of the most versatile processes for tranferring ink and technical coating. Printing can be done on paper, textiles, ceramics, and plastics, in the form of endless webs and single sheets, and also on objects of the most varying nature and shape, such as glasses, mugs, and controls panels.
- Screen Printing is a push-through process, a special type of stencil printing, which means that during the printing process the ink passes through the screen and onto the substrate.
- Screen printing is a process in which ink is forced through a screen. Its carried printing is carried out by forcing a pigment medium through an aperture or around a shape cut form stiff paper or thin metal sheet.
- The screen printing stencil serves as a printing plate.
- More often than not, the screen is a fine fabric made of natural silk, plastic, or metalfibers/ threads.

Process:

- Screen Printing is a printing technique wherby a mesh is u used to transfer ink onto a substrate, except in areas made impermeable to the ink by a blocking stencil.



- A blade or squeegee is moved across the screen to fill the open mesh apertures with ink, and a reverse stroke then causes the screen to touch the substrate momentarily along a line of contact.
- This causes the ink to the wet the substrate and be pulled out of the mesh apertures as the screen springs back after the blade has passed.

STENCILING TECHNIQUES:

A method of stencilling that has increased in popularity over the past years is the photo emulsion technique;

- The original image is created on a transparent overlay, and the image may be drawn or painted directly on the overlay, photocopied, or printed with a computer printer, but making so that the areas to be inked are not transparent.
- A black and white positive may also be used (projected onto the screen). However, unlike traditional plate making, these screens are normally exposed by using film positives.
- A Screen must than be selected. There are several different mesh counts that can be used depending on the detail of the design being printed.
- Once a screen is selected, the screen must be coated with emulsion and put to dry
- in a overlay room. Once dry, it is then possible to burn/ expose with a light source containing nornal tube light in 6 mins.
- The screen is washed off thoroughly. The areas of emulsion that were not exposed to light dissolve and wash away, leaving a negative stencil of the image on the mesh.

TESTING:

CIE Lab:

CIE - International Commission of Illumination. This is the organization responsible for setting the world-wide color measurement standards. An organization called CIE (Commission Internationale de l'Eclairage) determined standard values that are used worldwide to measure color. The values used by CIE are called L*, a* and b* and the color measurement method is called CIELAB.

Normal Screen Printing Ink :

Formula: $\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

White Print - 60 Gsm:

$\Delta l^* = 28.2$	$\Delta a^* = 23.2$	$\Delta b^* = -61.9$

$$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$
$$\Delta E = \sqrt{(28.2)^2 + (23.2)^2 + (-61.9)^2}$$
$$= \sqrt{795 + 538 + 3832}$$
$$= \sqrt{5165}$$
$$\Delta E = 71.8$$

Art Paper - 130 Gsm:

$\Delta l^* = 27.9$	$\Delta a^* = 27.7$	$\Delta b^* = -65.9$

$$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$
$$\Delta E = \sqrt{(27.9)^2 + (27.7)^2 + (-65.9)^2}$$
$$= \sqrt{778 + 767 + 4343}$$
$$= \sqrt{5888}$$
$$\Delta E = 76.7$$

Art Board - 300 Gsm:

$\Delta l^* = 27.3$	$\Delta a^* = 27.7$	$\Delta b^* = -68.9$

$$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$
$$\Delta E = \sqrt{(27.3)^2 + (27.7)^2 + (-68.9)^2}$$
$$= \sqrt{745 + 767 + 4747}$$
$$= \sqrt{6259}$$
$$\Delta E = 79.1$$

Citronella Oil Mixed In Screen Printing Ink:

Batch - I White Print - 60 Gsm:

Formula: $\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

Oil Ratio: 20 %

$\Delta l^* = 34.0$	$\Delta a^* = 20.0$	$\Delta b^* = -65.5$

$$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$

$$\Delta E = \sqrt{(34.0)^2 + (20.0)^2 + (-65.5)^2}$$

$$= \sqrt{1156 + 400 + 4356}$$

$$= \sqrt{5912}$$

$$\Delta E = 76.8$$

Oil Ratio: 30 %

$\Delta l^* = 34.5$	$\Delta a^* = 21.3$	$\Delta b^* = -64.3$

$$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$

$$\Delta E = \sqrt{(34.5)^2 + (21.3)^2 + (-64.3)^2}$$

$$= \sqrt{1125 + 454 + 4135}$$

$$= \sqrt{5716}$$

$$\Delta E = 75.6$$

Oil Ratio = 40%

$\Delta l^* = 36.7$	$\Delta a^* = 18.8$	$\Delta b^* = -62.8$

$$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$

$$\Delta E = \sqrt{(36.7)^2 + (18.8)^2 + (-62.8)^2}$$

$$= \sqrt{1347 + 353 + 3944}$$

$$= \sqrt{5644}$$

$$\Delta E = 75.1$$

BATCH - II

Art Paper - 130 Gsm:

Formula: $\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

Oil Ratio: 20 %

$\Delta l^* = 31.5$	$\Delta a^* = 24.9$	$\Delta b^* = -67.5$

$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

$\Delta E = \sqrt{(31.5)^2 + (24.9)^2 + (-67.5)^2}$

$= \sqrt{1024 + 625 + 4624}$

$= \sqrt{6273}$

$\Delta E = 79.2$

Oil Ratio: 30 %

$\Delta l^* = 29.4$	$\Delta a^* = 27.4$	$\Delta b^* = -66.8$

$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

$\Delta E = \sqrt{(29.4)^2 + (27.4)^2 + (-66.8)^2}$

$= \sqrt{864 + 751 + 4489}$

$= \sqrt{6104}$

$= 78.1$

Oil Ratio: 40%

$\Delta l^* = 32.3$	$\Delta a^* = 24.5$	$\Delta b^* = -66.3$

$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

$\Delta E = \sqrt{(32.3)^2 + (24.5)^2 + (-66.3)^2}$

$= \sqrt{1043 + 600 + 4396}$

$= \sqrt{6039}$

$\Delta E = 77.7$

BATCH - III

Art Board - 300 Gsm:

Formula: $\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

Oil Ratio: 20 %

$\Delta l^* = 32.1$	$\Delta a^* = 26.3$	$\Delta b^* = -68.9$

$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

$\Delta E = \sqrt{(32.1)^2 + (26.3)^2 + (-68.9)^2}$

$= \sqrt{1030 + 692 + 4747}$

$= \sqrt{6469}$

$\Delta E = 80.4$

Oil Ratio: 30 %

$\Delta l^* = 29.7$	$\Delta a^* = 26.7$	$\Delta b^* = -65.4$

$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

$\Delta E = \sqrt{(29.7)^2 + (26.7)^2 + (-65.4)^2}$

$= \sqrt{882 + 713 + 4277}$

$= \sqrt{5872}$

$\Delta E = 76.6$

Oil Ratio: 40%

$\Delta l^* = 31.7$	$\Delta a^* = 26.2$	$\Delta b^* = -67.8$

$\Delta E = \sqrt{(\Delta l^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

$\Delta E = \sqrt{(31.7)^2 + (26.2)^2 + (-67.8)^2}$

$= \sqrt{1005 + 686 + 4597}$

$= \sqrt{6288}$

$\Delta E = 79.2$

SOLID INK DENSITY (SID):

Density is the ability of a material to absorb light. Generally, the darker a process color is to the eye, the higher the density. Density measurements of solid ink patches are used to monitor the ink film thickness applied during a press run.

Normal Screen Printing Ink:

Substrate	Density
60gsm - White print	1.39
130gsm - Art paper	1.41
300gsm - Art board	1.4

Cironella oil mixed in Screen Printing Ink:

Batch - I

Ratio	Substrate	Density
20%	60gsm - White print	1.24
	130gsm - Art paper	1.33
	300gsm - Art board	1.31

Batch - II

Ratio	Substrate	Density
30%	60gsm - White print	1.23
	130gsm - Art paper	1.37
	300gsm - Art board	1.35

Batch - III

Ratio	Substrate	Density
40%	60gsm - White print	1.16
	130gsm - Art paper	1.29
	300gsm - Art board	1.31

SCUFF RESISTENENCE:

This test is intended to evaluate the rub resistance of prints on paper or board. It can also be used to measure / evaluate color transfer from printed / coated surface during rubbing. Two samples of the same substrate are rubbed against each other in the same plane, under a constant pressure of 2 psi and at a fixed speed of 60 RPM. The numbers of rubs are recorded using a non-contact type digital counter.

Normal Screen Printing Ink:

Substrate	Scuff
60gsm - White print	60 Rubs
130gsm - Art paper	100 Rubs
300gsm - Art board	100 Rubs

Citronell oil Mixed in Screen Printing Ink:

Batch - I

Ratio	Substrate	Scuff
20%	60gsm - White print	60 Rubs
	130gsm - Art paper	100 Rubs
	300gsm - Art board	100 Rubs

Batch - II

Ratio	Substrate	Scuff
30%	60gsm - White print	60 Rubs
	130gsm - Art paper	100 Rubs
	300gsm - Art board	100 Rubs

Batch - III

Ratio	Substrate	Scuff
40%	60gsm - White print	60 Rubs
	130gsm - Art paper	100 Rubs
	300gsm - Art board	100 Rubs

ABSORPTION AND DRYING PROPERTIES:

Drying is achieved in one of several possible ways de- pending on the type of ink or varnish and the method of application. The fluid vehicle must either be removed or transformed to the solid state.

Normal Screen Printing Ink:

Substrate	Absorbtion
60gsm - White print	6 Minutes
130gsm - Art paper	9 Minutes
300gsm - Art board	9 Minutes

Citronella Oil Mixed in Screen Printing Ink:

Batch - I

Ratio	Substrate	Absorbtion
20%	60gsm - White print	6 Minutes
	130gsm - Art paper	9 Minutes
	300gsm - Art board	9 Minutes

Batch - II

Ratio	Substrate	Absorbtion
30%	60gsm -White print	6 Minutes
	130gsm -Art paper	9 Minutes
	300gsm -Art board	9 Minutes

Batch - III

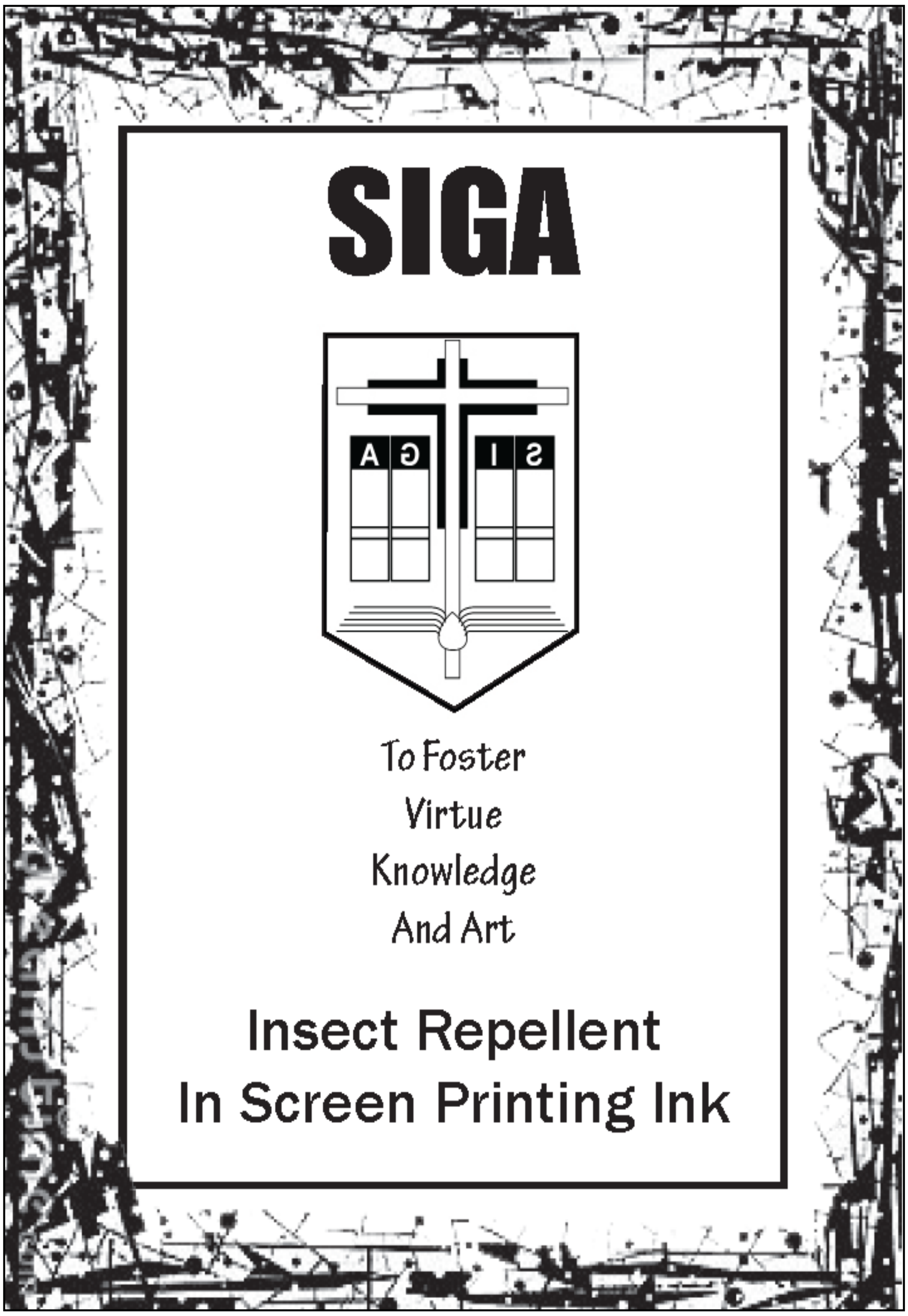
Ratio	Substrate	Absorbtion
40%	60gsm - White print	6 Minutes
	130gsm - Art paper	9 Minutes
	300gsm - Art board	9 Minutes

CHAPTER V

RESULT

We took printed samples that is calenders to mixed with citronella oil in different substrate, and have learnt screen printing process and how to use in various equipments from this experience. We have learnt about the citronella oil and this characteristics.

Finally we printed with Monthly Callenders.



60 - gsm White Print

130 - gsm Art Paper

300 - gsm Art Board

SIGA

JANUARY 2017

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

FEBRUARY 2017

SUN	MON	TUE	WED	THU	FRI	SAT
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5	6	7	8	9	10	11
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26	27	28				

SIGA

MARCH 2017

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SIGA

APRIL 2017

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30						

SIGA

MAY 2017

SUN	MON	TUE	WED	THU	FRI	SAT
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7	8	9	10	11	12	13
1	51	61	1	18	9	20
21	22	23	24	25	26	27
28	29	30	31			

JUNE 2017

SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	02	21	22	23	24
25	26	27	28	29	30	

JULY 2017

SUN	MON	TUE	WED	THU	FRI	SAT
						1
2	3	4	5	6	7	8
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16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

SIGA

AUGUST 2017

SUN	MON	TUE	WED	THU	FRI	SAT
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6	7	8	9	10	11	12
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20	21	22	23	24	25	26
27	28	29	30	31		

SIGA

SEPTEMBER 2017

SUN	MON	TUE	WED	THU	FRI	SAT
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17	18	19	20	21	22	23
24	25	26	27	28	29	30

SIGA

OCTOBER 2017

SUN	MON	TUE	WED	THU	FRI	SAT
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

NOVEMBER 2017

SUN	MON	TUE	WED	THU	FRI	SAT
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

SIGA

DECEMBER 2017

SUN	MON	TUE	WED	THU	FRI	SAT
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

EXPERIENCE

We would like to share our experience with one and all as the part of our academic programme. We stepped into the project work with lot of expectations and eagerness to learn about the screen printing process, citronella oil, and also about scuff, lab, density and absorption test. We found this institution is the right place to learn about the screen printing process and all the technical details used in screen printing and ink mixtures. And we have learnt about the printing department and mainly screen printing process and different testing process.

We came to know about the working procedure of the screen printing and different tests There is a lot of effect to put up in this project to print using normal screen printing ink, citronella mixed screen printing ink and to perform different tests for the different printed substrate. We learned and analysed about the characteristic of citronella oil, screen printing process, screen printing ink, designing a calender using software and about the different tests for printed substrate while doing LAB and DENSITY test we learned about spectrometer and how to use spectrometer. We also learned to use scuff resistance machine.

In this project help us to know us about the work flow of the screen printing, characteristic of citronella oil, screen printing ink, different substrate tests and we got good experience and learned more about the screen printing process and citronella oil. And then we finally thank to the staff and the management of our college of SIGA Polytechnic College Fr. Charles Gasper,.SDB our college principle, staff and specially thank our project guide Mr. V. Jhon Fedrick for proper guidance all throughout the project.

EXPENSES INCURRED FOR THE PROJECT

Screen Materials	-	1200
Screen Preparation	-	450
Ink	-	900
Oil	-	1400
Travel Allowance	-	700
Printouts	-	3000
Miscellaneous	-	800
Total	**-**	**8450**

CONCLUSION

As we conclude my project report we happy that we have learned many things not only about my topic we have chosen, but also on many things like working together as a team, learning to approach the manager, collecting information from the person etc.W It was a learning experience for each of us as an individual as well as group. This experience would make and impact in our studies as well as in the career we choose. We have learnt many things about how the technology in the industry. We are grateful to thanks all the companies and the persons who helped us out of their what to make our project success. We are also grateful to find out who is more helpful or all the screen printing industry which helped us to finish up our project with the given time. Our team members were so happy to do this project in the industry of screen printing. Our student were surprise to see the screen printing and citronella oil, final callender design and the tests results.

This conclusion of the project report says that is project work of our student is going to an end. During this period, we have been experienced by the management and the staff of various company helped us a long way in out carrier. The project work helped us a lot to land the mind set of the industry and to find the all the difficulties which are naturally exiting in the industry. It also helped to analyse the expectation of the customers. Work is more helpful for us to find out what is actually happing in the industries this project. And finally this experience who in the helped us a lot to be a part of the industry in the future. Though many of them were busy with the own schedule they were kind enough to extend their help towards our project.

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