Chapter – 2

Evolutive perspectives of paint
Introduction

In the preceeding chapter a frame work of research study has been given in order to project an idea of systematic work to be done for exploring the new areas in training and development perspective in paint industry in India. Before making an in-depth study of the subject it is felt pertinent to discuss the historical concept of paint and paint industry.

Paint has been with us for a quite long period since prehistory. The present state of sophisticated paint has passed its life for about 40000 years. Various literatures on history of paint have revealed that there has been chronological development of this industry and almost every century there has been some change or discovery or invention of new colour or new technique. To have an in-depth idea about the use of paint in various activities a brief discussion on phases of development is made here.

2.1 The paint – a conceptual idea.

Paint is a group of emulsions generally consisted of pigments suspended in liquid form for use as decorative or protective coatings.

There are three basic things required to make paint-pigment, binder and thinner. Pigment is used to get exact colour, binder is used to hold the paint together and thinner is used to apply paint easily. Sometimes dyes are used with pigments. Pigments may be natural and it may contain various clays, calcium carbonate, mica, silicas and talcs. Synthetic pigments include engineered molecules, calcined clays, blane fix, precipitated calcium carbonate and synthetic silicas. Hiding pigments protect the substance from the harmful effects of ultraviolet light. Hiding pigments include titanium dioxide, phthalo blue, red iron oxide and many others. Filler pigments, a special type, usually comprised of cheap and inert materials, such as talc, lime, baryte, clay etc. The use of proportion of paints varies from organisation to organisation. Commercially important pigment is titanium dioxide. Titanium dioxide was first discovered by
famous historian Joe Bortel\(^1\) in the 19th century. The titanium dioxide used in most paints today is often coated with silicon or aluminium oxide for better exterior durability or better hiding performance. Some pigments are toxic, such as lead pigments that are used in lead paint. Paint manufacturers began replacing while lead pigments with the toxic substitute.

The binder or resin is the actual film forming component of paint. It is the only component that must be present. The binder imparts adhesion, binds the pigments together and strongly influences such properties as gloss potential, exterior durability, flexibility and toughness. Binders include synthetic or natural resins such as acrylics, polyurethanes, polyesters, melamine resins, epoxy or oils. Binders may be categorised according to drying mechanism. The four most common are simple solvent evaporation, oxidative cross linking, catalysed polymerization and coalescence. Paints that dry by simple solvent evaporation contain a solid binder dissolved in a solvent.

**Volatile vehicle or solvent:** The main purpose of volatile vehicle is to adjust the viscosity of the paint. It can control flow and application of properties. Volatile substances impart their properties temporarily - once the solvent has evaporated or disintegrated, the remaining paint is fixed to the surface. Solvent based, sometimes called oil based, paints can have various combinations of solvents as the vehicle, including aliphalics, aromalics, alcohols, and ketones. These include organic solvents such as petroleum distillate, esters, glycol ethers, and the like.

**Additives:** Besides the three main categories of ingredients, paint can have a wide variety of miscellaneous additives, which are usually added in very small amounts and yet to give a very significant effect on the product. Some additives are used to modify surface tension, improve flow properties, improve the finished appearance, incensed wet edge, improve pigment stability, import antifreeze properties central forming, central skinning. Other types of additives include catalysts, thickeners, stabilizers, emulsifiers, texturizers, U.V. Stabilizers, fatteners, biocides to fight bacterial growth, and the like.

\(^1\) http://en.wikipedia.org/wiki.paint-page-1
## KINDS OF PAINTS AND THEIR USE

### Table – 2.1

Showing the different types of paints and its uses

<table>
<thead>
<tr>
<th>Name of paints</th>
<th>Uses of Paints</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Primer²</td>
<td>It is a preparatory coating put on materials before painting. It ensures better adhesion of paint to the surface, increases paint durability.</td>
</tr>
<tr>
<td>2. Varnish</td>
<td>It provides a protective coating. It does not contain pigment.</td>
</tr>
<tr>
<td>3. Wood stain</td>
<td>It is very thin type paint and penetrates the surface rather than remaining in a film on top of the surface.</td>
</tr>
<tr>
<td>4. Lacquer</td>
<td>It is fast drying solvent-based paint that produces hard and durable finish.</td>
</tr>
<tr>
<td>5. Enamel paint</td>
<td>It is hard type paint usually finishes glossy</td>
</tr>
<tr>
<td>6. Roof coating</td>
<td>It is a fluid applied membrane which has elastic properties that allows it to stretch and return to the original shape without damage.</td>
</tr>
<tr>
<td>7. Finger paints</td>
<td>It’s a kind of paint intended to be applied with the fingers.</td>
</tr>
<tr>
<td>8. Glaze</td>
<td>It is an additive used with paint to slow drying time and increase translucency, as in Faux painting and art painting.</td>
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</tbody>
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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>9. Inks</td>
<td>It is similar to paints. They are typically made using finely ground pigments or dyes.</td>
</tr>
<tr>
<td>10. Titanium dioxide</td>
<td>It is extensively used for both house paint and artist's paint, because it is permanent and has good covering power.</td>
</tr>
<tr>
<td>11. Anti-Graffiti&lt;sup&gt;3&lt;/sup&gt;</td>
<td>These are used to defeat the marking of surfaces by graffiti artists.</td>
</tr>
<tr>
<td>12. Anti-climb</td>
<td>This paint is non-drying and appears normal but extremely slippery. It is usually used in drain-pipes. When a person attempts to climb objects coated with the paint, it rubs off on to the climber, as well as making it hard for them to climb.</td>
</tr>
<tr>
<td>13. No-voc paints</td>
<td>This is solvent-free paints and does not contain volatile organic compounds. It has been available since late 1980s.</td>
</tr>
</tbody>
</table>

2.2 USERS OF PAINTS.

Table -2.3

Users of Paints

- HOUSEHOLD SECTOR, THE INDIVIDUALS.
- BUILDING AND CONSTRUCTION INDUSTRY.
- AUTOMOBILE INDUSTRY.
- RAILWAY COACH FACTORIES.
- FURNITURE INDUSTRY.
- IRON FURNITURE INDUSTRY.
- IRON AND STEEL INDUSTRY.
- SHIP BUILDING INDUSTRY.
- ALUMINUM INDUSTRY.
- CERAMIC INDUSTRY.
- CEMENT INDUSTRY.
- RUBBER INDUSTRY.
- SOFTWARE INDUSTRY.
- PLASTIC INDUSTRY.
- AIRCRAFT INDUSTRY.
2.3 Application of paint

Paint can be applied as a solid, gaseous or a liquid. This is given in table-2.2

<table>
<thead>
<tr>
<th>Status/Form</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid form</td>
<td>Paint is applied as a very fine powder, then backed with high temperature. This melts the powder and causes it to adhere to the surface. This is commonly known as &quot;powder coatings&quot;</td>
</tr>
<tr>
<td>Gaseous form</td>
<td>The paint is suspended in solid or liquid form in a gas that is sprayed on an object. The paint sticks to the object. This is known as spray-painting. The application mechanism is air and there no solid object; even touches the object being painted.</td>
</tr>
<tr>
<td>Liquid form</td>
<td>Paint can be applied by direct application using brushes, paint rollers, blades or other instruments.</td>
</tr>
</tbody>
</table>

A brief discourse on evolution of paint:

It is now felt pertinent to have a brief discussion on developmental phases of paints over centuries. For the convenience of getting a thorough knowledge on the evolutive aspect of paint discussion is made on three phases.

• Phase-I (Prior to 1800 AD):

This phase marked as oldest phase in the history of paint. This phase is mainly concerned with cave painting with red and yellow ochre, hematite, manganese oxide and charcoal. All these might have been made by Homo sapiens about 400005 years ago. About 300006 years ago pigments were used in paintings by Egyptians. The oldest civilization (Mediterranean) Roman and Egyptians have extensively used painting techniques based on mixtures of encaustic, mineral pigments (iron, copper, manganese oxide) and tempera. Egyptians also used flax, walnut or poppy seed oil for paints. Some countries of Europe like Italy and Germany also came in the picture of discovery of paints. One of the earliest colour discoverers was plato. Roman gave us purple during this period. Mainly this period is concerned with Roman and Egyptian culture.

After the Roman and Egyptian culture, revolution of paints in China is an important factor. Chinese is concerned with manufacture of paints looking to its qualitative perspectives in its entirety and also its use in a state of perfection. It was about 10,0007 years ago when "Blue Frit" was produced as synthetic pigment by Egyptians. That means Egyptians dominated in paint use till 5,0008 years ago and Chinese were their counter parts.

The discovery of "red lead" paints in about 2,500 B.C. is also an important step. This period was dominated by Amidenus, a medical writer, who mentioned dying oil as a varnish or paintings. Greek and Romans also occupied important place in its use. In the 1,000 B.C. the development of paint and varnishes was based on Gum of the acacia tree- the colours were Egyptian blue, Maples yellow.

5 www.wikipedia.org/wiki/paint page-7
6 www.paint.org/industry/history.cfm page-1
7 www.realpaints.com/history.htm Page-1
8 www.brendaasmanick.com/art/historyofpaint.htm Page-1
Japanese dominance between 6th century and 14th century A.D. is worthy to be mentioned. They developed "perilla oil" for use of paints. In the 12th century a German Monk, Mr. Theophilus appeared and he warned use of olive oil. The drawback of olive oil was that the drying time was very long and tedious in case of figures. So, the varnish on painting was discovered by a medical man to remove the deficiency of olive oil.

In the 14th century, Cennino Cennini\textsuperscript{9}, presented a painting procedure integrating tempera painting covered by light oily layers. At the same time perilla oil was also being used in Japan.

The period of 14th century to 16th century is termed as 'Renaissance' in the history of paint. Some important personalities like Giorgio\textsuperscript{10} Vasari (1511-1574), Jan Van Eyck (1390-1441), Antonelllo da Messina\textsuperscript{11} (1430-1479), Leonardo da vinci\textsuperscript{12} (1452-1519), Giorgione (1477-1510), Titian\textsuperscript{13} (1488-1576) and Tintoreto (1518-1594) appeared in paint manufacturing history. Mr. Georgio developed painting which is still used now-a-days. Mr. Jan van modified same with some new formula of the oil painting. Actually he developed a stable varnish based on siccative oil as a binder of mineral pigments. He used a mixture of piled glass, calcined bones and mineral pigments at a boiling temperature. Besides, linseed oil, walnut oil and poppy seed oil were also used in that time. Mr. van Eyck observed that the oils accelerate the time of drying. So his new formula was more acceptable.

After Jan van, Mr. Antonilloda introduced a new technical improvement. He added that a "lead oxide" in the pigment oil mixture may increase their seccative property. After that came in picture Mr. Leonardo da vinci who improved the preparation of oil mixture by adding 5 to 10% bee wax, which prevents from dark colour.

After that came in the history of paint Mr. Giorgione, Titan and Tintoreto those have slightly altered the techniques and dominated about three centuries in

\textsuperscript{9} www.cyberlipid.org/prox/oxid0011.htm-page-1/2
\textsuperscript{10} www.cyberlipid.org/prox/oxid0011.htm-page-1/2
\textsuperscript{11} www.cyberlipid.org/prox/oxid0011.htm-page-1/2
\textsuperscript{12} www.cyberlipid.org/prox/oxid0011.htm-page-1/2
\textsuperscript{13} www.cyberlipid.org/prox/oxid0011.htm-page-1/2
whole Europe.

During the centuries of 17th and 19th Dutch came in picture and greatly influenced the paint industry by inventing "Stack process". It is less costly. This led to the development of white lead. All white lead paints included chalk in their undercoats, reserving purer white lead for finished coats. During this period dyestuff was used and pigment colour developed in Europe. Such form of natural dyestuffs in central America and India was in existence. Before nineteen century the world "paint" was only applied to oil bound types and when these were bound with "glue" they were named as "distemper". From 1600, Mr. Rubens\(^\text{14}\) studied in Italy and made his own improvement and used walnut oil warmed with lead oxide and some mastic to grind mineral pigments. European painters mostly used linseed, walnut and poppy seed oil.

In 1724\(^\text{15}\), there has been break through in the development of "prussian Blue" which is intense deep blue. This continued for a quite long period and gained importance. In 1778\(^\text{16}\), there was another development of "scheele's green" a much less poisonous green and that has been very favourite to all. Another breakthrough in the history of paint came in year 1781 with development of Turner's patent yellow.

- **Phase-II (1800 AD to 1899AD)**:

This 19th century has been a remarkable history for paints. This begins with 1818 AD with the discovery of strong, light fast yellow of water resistant "chrome yellow"\(^\text{17}\). Thereafter a mixture of prussian blue and chrome yellow was produced to be known as "Brunswick greens". Then developed "cerubean", one particular blue, between 1820 to 1840. In 1856 the first real synthetic dye, "Mauveine", was discovered by Henry Perkins. It was then that linsed oil began to be produced. The most remarkable in the history of paint was discovery of washable paint named as " charlton white" in 1870\(^\text{18}\) by D.R. Avrill of Ohio. The

\(^{14}\) [www.cyberlipid.org/prox/oxid0011.htm-page-2]
\(^{15}\) [www.realpaints.com/history.htm-page-1]
\(^{16}\) [www.realpaints.com/history.htm-page-1]
\(^{17}\) [www.realpaints.com/history.htm-page-1]
\(^{18}\) [www.realpaints.com/history.htm-page-1]
The Sherwin-Williams Company spent few years to make a perfection in the formula of fine paint. In 1880 they got a new formula and improved the quality of paints. In 1880 the new paints of high quality were made available in tins and delivered all over the world.

- **Phase III (1900 onwards):**

  This century is mainly concerned with development of mass production of paint. Immediate after the first world war the functioning of the activities in paint industry was disturbed. But subsequently production increased through the use of sophisticated techniques and new paints appeared in market all over the world including India. Again during world war II the production of paint industry suffered a great jolt and it restored its normalcy immediately the war was over. It was during 1960s the petrochemical companies promoted plastic paints which have been in continuous use. The later part of 20th century showed a glaring picture in production and sales of paint products. A hypercompetitive market all over the world appeared in different corners of the world and in India after national economic policy was introduced.

  The foregoing discussion gives an idea that paint making/ manufacture consists of complex techniques and methods that needs a level of high quality of skill, ability and aptitude. This undoubtedly leaves a ground to study the people's competency for quality production and services with the objective of achieving excellence in performance of organisational goal.

  So it is quite relevant to have an indepth idea of the mechanisms/ techniques that improves/ promotes people's knowledge, skill and abilities (KSA).

  In the next chapter a threadbare discussion has been made on training and development as an effective tool/ mechanism for enriching knowledge and enhancing competency of the people at work.