TREATMENT OF PAINT CONTENT IN EFFLUENTS OF AUTOMOBILE INDUSTRIES

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ABSTRACT
Paint is one of the most important products. It is used for various purposes in automobile industries, toy industries, painting industries and building works etc. The exact composition of particular paint is often complex and proprietary. In general, however, most paints contain the material like binder (resin), solvents, pigments and additives. In automobile industries, paints are used in bulk quantity. Before painting phosphate coating is given for improving paint adhesion and to increase corrosion resistance. Due to porous coating Paint adhesion is improved and because it has thermal expansion properties intermediated between the metal and the paint. Zinc phosphate is also recommended for maximum corrosion resistance.

The effluents, which are generated from the automobile industries, are creating a big problem to the environment. Environmental health hazards arise to the workers when they are exposed to the air, drinking water and food, which may get polluted due to spraying of the paints. Mostly alkyd paint are used for painting process. During this process large amount of water is used and get polluted. Attempts has made to make simple treatment of effluents generated from automobile industries. Calcium Hydroxide and Alum are chemicals used for the experiments. Alum along with polymer shows an effective treatment of effluents. Results obtained are encouraging and worth mentioning too.

Key Words : Alum, Polyelectrolyte, Odor, COD, Automobile industries, Pigments, Solvents

INTRODUCTION

In the 1970s, there was a substantial change in the consumption of construction paints in many countries. Most recent developments are the carrying out of life cycle assessments (LCAs) on the paint in connection with eco-labeling studies, along with needs to apply environmental management system (EMSs) in manufacture, LCA carries through to ultimate disposal including consideration of recycling of paint, paint waste and packaging.

In Germany, some water based construction paints (WCP) have the image and label of “Environmentally safe products” which makes them popular with do-it-yourself painters. The term ‘paint’ sometimes use in a general way to describe all the surface coating manufactured by the industry. However, the term usually is used in a more specific way to designate a highly pigmented coating.

In the broadest sense a paint may be
defined as a mixture of pigment, binder, thinner and additives which when spread in a thin film forms a solid, adherent surface coating.

The pigment gives the paint colour and hiding power; the binder acts as a film-former, which holds the pigment on the painted surface; the thinner brings the pigment-binder mixture to a suitable consistency for application, and the additives impart special properties such as rapid drying. The binder plus the thinner is called the “vehicle” because together these two components carry the pigment to a surface. The pigment plus the binder (and some additives) make up the non-volatile matter, which becomes the dried paint film.

There are two types of paints used in different processes of industries, one is water based paint and another is alkyd paint. Water based paint are also referred as “latex” paint. These offer the easiest application and soap water clean up are the fastest drying and have fewer odors than solvent paints. Where as alkyd paint is referred as “oil-based” paint, but alkyd paints are creating more pollution as compare to water based paint.

This type generally cost more than latex; application requires patience thin coats are generally necessary to avoid problems like sagging and streaking and the drying time is usually longer than latex.

Automobile industries consume bulk quantity of paint during painting process. This process generates highly contaminated effluent containing paint particles. Suppose this contaminated effluent released as it is in nature will create various problems. It may contaminated ground water or may create heavy pollution in natural water bodies.

Therefore proper treatment technique must be adopted to control pollution. Effluent generated from automobile industries contains various heavy metals like zinc, lead, copper, sulphate, phosphate, chromium, nickel etc. Each heavy metal has a specific effect on the ecosystem when released at higher concentration.

MATERIAL AND METHODS

Effluent samples were collected for a period of one month from automobile industry at Waluj in Aurangabad. Per day near about one liter of effluent sample collected in plastic
bottle for experimental work. Collected effluent sample was highly contaminated by paint particles. These effluent samples are treated by two different methods:

(1) Ca(OH)₂ and with polyelectrolyte (cation)
(2) Alum with polyelectrolyte (cation)

Study area was Waluj, Aurangabad, Maharashtra (India). The aqueous medium of dye extraction, dyeing was carried out.

RESULTS AND DISCUSSION

Large quantity of paint is required for painting process in automobile industries. Effluent generated from this process is contaminated with paint particles turbid in nature as thus particles always remain in suspension form. Water has the ability to dissolve soluble substances and heavy metals.

Paint is non-biodegradable pollutants. Paint is organic in nature, which is insoluble in water. Hence it is necessary to remove all paint particles present in the effluent. These paint particles are separated by using some chemicals like Ca(OH)₂ and alum.

While conducting experiment, after addition Ca(OH)₂ and polyelectrolyte (cation), in the effluent it was observed that heavy flocks with good setability gets settles at the bottom. The sludge generated is 3-4% on dry basis. After addition of polyelectrolyte the suspended particles present in the effluent gets coagulated which result in formation of heavy flocks having density more than that of surrounding effluent. This higher density helps in separation of solid and liquid phase i.e. paint particles present in the effluent.

70-80 mg/l of alum along with polyelectrolyte is capable to separate the paint suspension. The quantity of sludge generated is 2-3% on dry basis. The colour of the effluent reduces from dark black to colorless.

In present investigation two chemicals are utilized for the treatment purpose one is Alum and second is Ca(OH)₂.

During the experiment it was observed that 80 gm of alum (10 Rs/Kg) is required for 1 M³ 10 gm of polyelectrolyte is required for flocculation (Cost 300 Rs./Kg). Quantity of sludge generated was 20 kg. (Disposal Cost 4 Rs/Kg) 84 Rs/M³ are the treatment cost.

While conducting experiments with the calcium hydroxide it was observed that 10 kg of lime (Rate 4Rs/Kg) required for the treatment of 1 m³ of effluent. 10 gm of polyelectrolyte is required for flocculation (Cost 300 Rs./Kg). The quantity of sludge generated

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before Treatment</th>
<th>After Ca(OH)₂ Treatment</th>
<th>After ALUM Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Dark Brown</td>
<td>Light Yellowish</td>
<td>Colorless</td>
</tr>
<tr>
<td>Odour</td>
<td>Highly Objectionable</td>
<td>Non-Objectionable</td>
<td>Non-Objectionable</td>
</tr>
<tr>
<td>TDS mg/l</td>
<td>1712.0</td>
<td>1372.0</td>
<td>1310.0</td>
</tr>
<tr>
<td>pH</td>
<td>6.5</td>
<td>10.5</td>
<td>6.00</td>
</tr>
<tr>
<td>COD mg/l</td>
<td>804.0</td>
<td>404.0</td>
<td>401.0</td>
</tr>
</tbody>
</table>
was 30 Kg. The overall cost of the treatment is 163 Rs/ M$^3$

**Cost Benefit Analysis (CBA):** The present investigation shows that the treatment given by using Alum is much more beneficial than that of the Calcium hydroxide. The Overall benefit by using alum 79 Rs / M$^3$

<table>
<thead>
<tr>
<th>REQUIREMENT COST/M$^3$</th>
<th>ALUM</th>
<th>Ca(OH)$_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUANTITY OF CHEMICALS</td>
<td>80 gm (10 Rs/kg)</td>
<td>10 gm (4 Rs/kg)</td>
</tr>
<tr>
<td>POLY - ELECTROLYTE</td>
<td>10 gm (300 Rs/kg)</td>
<td>10 gm (300 Rs/kg)</td>
</tr>
<tr>
<td>SLUDGE GENERATED</td>
<td>20 kg</td>
<td>30 kg</td>
</tr>
<tr>
<td>COST OF TREATMENT</td>
<td>84 Rs.</td>
<td>163 Rs.</td>
</tr>
</tbody>
</table>

**Table 2:** Cost benefit ratio between alum and calcium hydroxide

**Fig. 2:** Deposition of metal hydroxide species on oppositely-charged particles, showing charge neutralization
CONCLUSION

It is concluded that alum along with the polyelectrolyte dosing is most suitable method for removal of paint suspension in automobile effluent. In this experiment it is observed that calcium hydroxide is also capable to remove the suspension at alkaline pH. But due to the addition of calcium hydroxide there is considerable increase in the quantity of sludge. The pH also increases up to 10.5 by calcium hydroxide while alum with polyelectrolyte dose decreases pH up to 5.0 so the quantity of respective chemicals required for the neutralization for both treatments are also changes considerably. The sludge generate from the calcium hydroxide is 30 kg/M$^3$ and
sludge from alum is 20 kg / M³. Both method shows almost same COD reduction. The effluent shows yellowish color after calcium hydroxide treatment while the effluent is colorless when treated by alum and polyelectrolyte. Thus alum with polyelectrolyte treatment is most economical and less sludge generating method.

REFERENCES