

DEVELOPMENT OF AN UNIVERSAL PAINT STRIPPER FOR METALS

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In general there are two types of strippers used to remove the old paint from the parts that need to be reworked. They are hot chemical solution and highly volatile organic solvent based systems. Nowadays, owing to environmental and health concerns, these strippers need to be replaced with more effective low temperature paint strippers. Based on this object, three types of paint strippers have been developed and the stripping performance of these formulations were carried out on different paint systems. The strippers are used to remove the coatings based on any type of binders such as alkyd, acrylic, epoxy, chlorinated rubber and polyurethane etc. The parameters such as effect of agitation, effect of temperature, time duration, thickness of the coating system and solvent concentration have been standardized. This study revealed that these paint strippers have been used as an universal stripper for removing any type of old or new coating system from any metallic surface.

Keywords: Paint stripper, removing old paints, peroxide, accelerator, temperature, time and agitation.

INTRODUCTION

It has been the practice to use abrasive blasting, wire brushing, power tool cleaning and chiseling to remove old adherent paint on erected structures for maintenance painting. These pretreatment methods are quite expensive and require lot of man power [1]. In addition to that in certain industries the abrasive blasting is strictly prohibited. Thus chemical methods of stripping and cleaning of the old paint from different surface have been developed. In chemical methods, paint strippers are most readily classified into organic strippers and inorganic strippers [2]. The organic strippers contain volatile, toxic and flammable solvents and so the clean Air Act and its amendments strictly regulate the amount of volatile organic compounds (VOC) that may be emitted. The inorganic strippers are acidic or alkaline in nature. It is harmful to the health of the workers. Hence these two methods need some modification to remove the old paint from the erected structures. In the present work, a neutral paint stripper based on peroxide has been developed [3]. The performance of this stripper with the acid and alkline based removers are compared and the results are explained.

EXPERIMENTAL

The neutral paint stripper was prepared from peroxide formulation. This formulation consists of a peroxide, and an accelerator. In addition to these chemicals small quantities of surfactant and thickening agents are also used for this formulation. The alkaline paint stripper is based on amine formulation. It consists of an amine and methylene chloride as major ingredient along with small concentrations of

surfactants and wetting agents. The acidic paint stripper consists of methylene chloride, formic acid, ethylene glycol and phenolic derivatives [4]. In our studies this formulation is slightly modified with aromatic alcohol accelerators.

The stripping effect of the new neutral paint remover has been tested on alkyd, polyester, chlorinated rubber, epoxy and polyurethane based coatings. The stripping effect of this stripper is also compared with the effect of acid and alkali based strippers. In addition to this, the effect of temperature, time and agitation to remove the adherent paint from the surface has been examined and discussed.

RESULTS AND DISCUSSION

The new stripper formulation was tested first with the complete removal of different types of paint coated on mild steel surface at different temperatures and the results are given in the Table I.

This result shows that the neutral stripper perform well to remove polyester, alkyd, polyurethane and chlorinated rubber based formulation. It will be used to remove epoxy coatings at fairly high temperature. From the table it is clearly seen that when the temperature increases, the stripping efficiency of the stripper also increases to remove the adherent paint from the metal surface.

When comparing the efficiency of this neutral stripper with other acid and alkaline stripper, the performance of this stripper is better than the others for removing alkyd, polyurethane and chlorinated rubber based coatings. The acid based strippers are useful to remove epoxy based coatings easier than the other two stripper formulations. The stripping

TABLE I: Time in minutes to effect 100% stripping of 6 mil thick coating

Temp (K)	Poly-ester	Alkyd	Poly-urethane	Chlorinated rubber	Epoxy
300	10	5	10	2	600 min
308	8	4	6	8	540 min
318	7	3	5	7	480 min
328	5	2	3	5	360 min
338	3	2	2	3	45 min

behaviour of the acid and alkaline based formulations are given in Table II.

From the table it is clearly seen that generally the acid and alkaline based formulations are useful to remove the old paint from the mild steel surface both at low and high temperatures, but the stripping efficiency is higher in the case of acid based formulations. The acid based formulations are particularly useful to remove epoxy coatings from the steel surface in lesser time duration than the other formulations. In general the acid and alkaline based formulations are hazardous to the workers and so these formulations are not widely used for stripping the old paint from the metal surface.

Effect of agitation

The new neutral paint stripper composition is made up of 70 vol/vol % of aqueous component and 30 vol/vol % of non volatile solvent component. Because this is a two phase system, agitation is needed. The greater the agitation the stripping time of the stripper solution is reduced. The Fig. 1 shows the stripping effect at two levels of agitation and without agitation to remove 6 mil thickness chlorinated rubber coating from mild steel substrate.

The agitation was produced by a mechanical stirrer. The low agitation means that the mixing speed was set so that the two phases were mixed. The high agitation represents mixing with a vortex. From the figure it was clearly seen that the agitation has considerably reduced the stripping time. Low

TABLE II: Time in minutes to effect 100% stripping of 6 mil thick coating

Stripper	Poly-ester	Alkyd	Poly-urethane	Chlorinated rubber	Epoxy
A at 298 K	20	15	25	25	720 min
A at 338 K	5	3	7	10	180 min
B at 298 K	10	7	10	15	420 min
B at 338 K	3	3	7	7	30 min

A = Alkaline formulation B = Acidic formulation

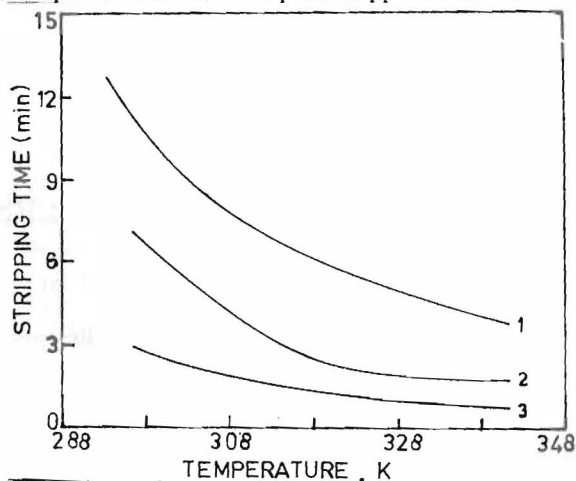


Fig. 1: Effect of agitation to remove 6 mil thick chlorinated rubber coating

(1) without agitation (2) low agitation (3) high agitation

agitation can reduce the stripping times by approximately 50%, when compared with the stripping time without agitation. Similarly the high agitation further reduced the stripping time to nearly 50%, when compared with the low agitated stripping solution. This results clearly indicate that agitation considerably reduce the stripping time of the adherent paint from the surface [5].

CONCLUSION

This new stripper effectively strips coatings based on alkyd, polyester, polyurethane and chlorinated rubber on metal surfaces at low temperatures. Removal of old adherent paint at low temperature affords many benefits such as saving energy and safety. But the enhanced temperature of the stripper helped to increase, the efficiency to peel off the coating from the metal surface and also to achieve the result in lesser time duration. Agitation of the stripper bath also reduces the stripping time considerably. The performance of the paint stripper is compared to that of other conventional chemical paint strippers such as acid and alkaline based strippers and found that the new stripper performed equally well to strip off the paint from the metal surface. Further the new stripper is not harmful to the users. In addition to environmental friendly formulation, it is non-corrosive to the base metal and leave the surface which can easily be recoated with the new coating system.

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