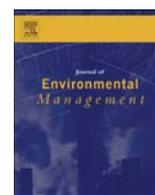




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## Review

## A review on paint sludge from automotive industries: Generation, characteristics and management

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## ABSTRACT

The automotive manufacturing process results in the consumption of several natural sources and the generation of various types of wastes. The primary source of hazardous wastes at an automotive manufacturing plant is the painting process, and the major waste fraction is paint sludge, which is classified with EU waste code of 080113\* implying hazardous characteristics. The amount of the paint sludge generated increases every year with the worldwide increase in the car production. The characteristics of the paint sludge, which mainly designate the management route, are mainly determined by the type of the paint used, application technique employed, and the chemicals applied such as flocculants, detackifiers, pH boosters, antifoam agents, and biocides as well as the dewatering techniques preferred. Major routes for the disposal of the paint sludges are incineration as hazardous waste or combustion at cement kilns. Because of high dissolved organic carbon content of the paint, the paint sludge cannot be accepted by landfills according to European Union Legislations. More investigations are needed in the field of paint sludge recycling such as recycling it as a new paint or as other formulations, or making use of the sludge for the production of construction materials. Research on the applicability of the paint sludge in composting and biogasification can also be useful. Ongoing research is currently being conducted on new application techniques to increase the effectiveness of paint transfer, which helps to prevent the generation of paint sludge. Advancements in paint and coating chemistry such as the reduction in the coating layers with its thickness also help to decrease the level of paint sludge generation. Investigations on the effects of the chemicals on the recycling potential of paint sludges and consideration of these effects by the chemical manufacturer companies would be extremely important. This review presents the formation of paint sludge, the factors affecting its characteristics, common disposal routes, the findings of the field trips to automotive manufacturing plants in Turkey, and a summary of the characterization findings of the paint sludge samples from a plant in Turkey.

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## 1. Introduction: automotive manufacturing plants and their environmental impact

The demand for vehicles and world car production has been increasing at a constant rate. The global vehicle production in 2014 reached 89.75 million units compared with 53.12 million units in 1997 (OICA, 2015). In Turkey, there are 13 automotive manufacturing plants (OEMs), producing over 1 million vehicles per year (ISPAT, 2014). Fig. 1 shows the yearly increase in the vehicle production in the world and in Turkey. The global vehicle ownership is reported to have climbed from approximately 47.6 million in

1960 to over 573 million in 2002 (Mayyas et al., 2012). The increase is expected to continue, as it is known that the global automotive manufacturers in Turkey, such as Toyota, Renault, Fiat, Hyundai, and Ford plan to increase their investments (ISPAT, 2014).

The presence of automotive manufacturers will naturally attract investments by automotive suppliers to the same geographical region, as seen in several cities in Turkey. There are 339 registered automotive suppliers, of which 47 have revenues exceeding 40 million USD in various Turkish cities (ISPAT, 2014).

Automotive companies and customers are usually concerned about the environmental and safety impacts of the use of automobiles. However, the environmental impacts of the automobile manufacturing process are also significant. The automotive manufacturing process results in the consumption of several natural sources and the generation of various types of gaseous, liquid

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