



# Bioconversion of industrial wastes: paint sludge from automotive manufacturing

Nezih Kamil Salihoglu<sup>1</sup> · Selnur Ucaroglu<sup>1</sup> · Guray Salihoglu<sup>1</sup>

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## Abstract

The compostability of water-based paint sludge originating from the automotive industry was investigated. Six reactors were operated. Wastewater treatment sludge from the same industry was used as additional substrate, and corncob was used as a bulking agent. The level of paint sludge within the compost mixtures varied between 55 and 85%. All reactors yielded a temperature increase up to thermophilic phase levels ( $>40\text{ }^{\circ}\text{C}$ ) for a minimum of 5 days, and organic matter and C/N losses were observed. BTEX concentrations decreased during composting. Nickel and tin levels in the final product exceeded the legal compost limits. The calorific value of the compost mixtures increased from 9532 to 18774 kJ/kg at the end of the composting process. It was seen that the process applied in this study can be utilized as a biodrying step before the usage of paint sludge at cement kilns as additional fuel.

**Keywords** Biodrying · Composting · Treatment plant sludge · Waste management · Cement kiln

## Introduction

The primary source of hazardous wastes at an automotive manufacturing plant is generally traced to the painting process [1]. Paint sludge represents the major form of the waste generated in painting processes; it is classified with the EU waste code of 080113\* implying hazardous constituents. Automotive plants generate from 1.5 to 5.0 kg of paint sludge per painted car. This sludge could be solvent-based or water-based, depending on the paint used. Water-based paint is mostly used in base-coat and solvent-based paint in clear coat applications. The solvent content of the solvent-based paint sludge could be recovered by distillation. However, there is not a common method to recycle the water-based paint sludge generated [2]. Because of its high dissolved organic carbon content, European Union Legislation does not allow landfilling of water-based paint sludge [2].

Since the demand for vehicles and world car production has been increasing and is expected to continue, and automotive manufacturers have been shifting from solvent-based paints to low-VOC water-based paints to meet the demands of environmental regulations, research is necessary for the recovery of water-based paint sludge. High organic carbon, nitrogen and low solvent content of the water-based paint sludge leads to the hypothesis that this sludge might be composted or biodried.

Composting is known as an environmentally friendly waste management option where the pathogens within the biodegradable organic matter are stabilized, and unstable forms of carbon and nitrogen are converted into stable forms [3, 4] while decreasing the volume. Very limited studies have been conducted related to the compostability [5–7] of paint sludge. Tian et al. [5] prepared a compost product containing 30% waste paint sludge mixture (water- and solvent-based paint sludge, 1:1 by weight). The researchers noted the role of waste paint sludge as nitrogen source and reported the increased growth of cucumbers when the compost was used. Tian et al. [6] prepared a compost product containing 17% waste paint sludge and evaluated the effects of starter compost, nutrients, gypsum and microbial inoculation on composting. They reported that melamine resin, which is a constituent of paint sludge, was degraded with a percentage varying between 73 and 95% with inoculation of

✉ Guray Salihoglu  
gurays@uludag.edu.tr  
Nezih Kamil Salihoglu  
nkamils@uludag.edu.tr  
Selnur Ucaroglu  
selnur@uludag.edu.tr

<sup>1</sup> Environmental Engineering Department, Faculty of Engineering, Uludag University, 16059 Bursa, Turkey