

Determination Of Optimal Conditions for Obtaining Shot from Houshoil Metal Waste

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Abstract

Six types of cans were used to obtain the shot (sardine, tomato, milk, varnish, paint and juice). Parameters of time, temperature and reaction media (HCl, NaOH, seawater and tap water) were screened as the optimal physical parameters in the experiments. Heated to 500 °C and introduced into the NaOH solution (0.2mol/L), shot was obtained after a six-month waiting period from juice cans. Increasing the temperature at 1080 °C, the shot was extracted with the five other types of metal cans used. This research showed that the temperature and basic medium were the optimum conditions for obtaining shot. It is deserved t to study the chemical composition of the metal cans in greater depth, with a view to use in the agriculture or craft industry in the future.

Keywords: Shot; Optimal conditions; Metallic rejets

Introduction

The metal cans made of non-toxic metals (iron, tin, aluminium) are used to preserve food products and the cans made of toxic metals (lead cadmium) or zinc are sorted non-food [1]. In Conakry (Guinea), residents usually burn various cans to get rid of the houshoil waste. However, these behaviours of burnt rubbish to produce the toxic products which are not only harmful to human but also contribute to environmental pollution.

The recycling system could recycle some useful productors from solid waste used in crafts, agriculture and industry. For example, recycling 1kg of aluminium can save 8kg bauxite, 4kg chemicals (carbon, aluminium fluoride and cryolite) and 13-15kWh electricity [2,3]. The aluminium recycling also saves up to 95% energy to produce the primary metal [3]. Indeed, the recycling system saves energy, reduces waste and provides additional income for recyclers. In addition, it is well known that metals are present in soils with various chemical forms, which influence the reactivity and hence the mobility and bioavailability [4].

In Guinea, recycle system was not well developed and the priority of houshoil waste were collected and transferred to inappropriate landfill sites. In the present study, we investigated the optimal conditions to recycle the cans from houshoil wastes. One hand, it could be a drive to recycle metal cans. The other hand, using a simple technique could be used to enrich soils that are poor in chemical elements. It's well know that the plants take up iron from the soil. Iron is an essential element for plants as it is involved in chlorophyll biosynthesis and photosynthesis [5].

Experimental Section

Materials

Metal cans (tomato, sardine, milk, paint, varnish and juice). Nabertherm oven (Schalt model), dessicator (Glaswerk Wertheim GL2), analytical balance (AC 120S, Sartorins), jars,

pH meter, stopwatch, cutting pliers. NaOH (0.2mol/L) and HCl solutions (0.2mol/L), seawater, mains water, distilled water.

Methods

The metal cans were collected by the selective sorting system from the household waste in the commune of Dixinn, Conakry. After cleaning, the cans were cut into strips. A 5g slice can was heated to a temperature of 500 °C for 30min or 1080 °C for 60min. After removing from the oven, the slice cans were placed in a desiccator for 3 hours to cool. They were reweighed before being placed in the jars containing the reaction media. An unheated "control" slide

weighing around 5g was inserted into each jar containing a heated slice of the same type. Previously heated slices were also exposed to open air for three months under laboratory bench conditions. The time elapsed for observation was 3 to 6 months.

Results and Discussion

Initially, the metal can strips were heated on a temperature below the melting point of the desired metals to elucidate that a temperature is less than 500 °C (Table 1). The melting points of iron, aluminium, tin, lead, zinc and cadmium are 1535 °C, 660 °C, 232 °C, 327 °C, 419 °C and 321 °C, respectively [6].

Table 1: The main information to obtain the shot from various cans.

Medium	Metal Cans	Temperature (T1 = 500 °C) Time (t1 = 30 min)		Temperature (T2 = 1080 °C) Time (t2 = 60 min)
		Observation	Observation	Observation
		after 3 months	after 6 months	after 3 months
Mains water (pH = 7.1)	Juice	Limpid solution	No shot	No shot
	Milk	Turbid solution		Shot
	Paint			
	Sardine			
	Tomato			
	Varnish			
Seawater (pH = 8.7)	Juice	Turbid solution	No shot	No shot
	Milk			Shot
	Paint			
	Sardine			
	Tomato			
	Varnish			
HCl (0.2 mol/L)	Juice	Turbid solution	No shot	No shot
	Milk			Shot
	Paint			
	Sardine			
	Tomato			
	Varnish			
NaOH (0.2 mol/L)	Juice	Turbid solution	Shot	No shot
	Milk		No shot	Shot
	Paint			
	Sardine			
	Tomato			
	Varnish			

Secondly, in the 0.2mol/L NaOH solution, the shot obtained from juice cans heated to 500 °C (Table 1), confirming that it was made of aluminium alloys (e.g.: Al (99.7%), Fe and Si (0.3%)) [7]. It has been reported that remelting aluminium scrap only consumes 2.8kWh/kg due to its low melting point (660 °C) [8]. The shot can be obtained easily from juice cans in an alkaline solution.

Finally, if the temperature is higher than the melting point of the desired metals, it could be the optimal temperature obtaining the shot.

Conclusion

In this study, we were able to obtain shot from juice cans by heated to 500 °C and dissolved in a 0.2mol/L NaOH solution after 6 months. Without a reaction medium, it was possible to obtain shot from metal cans. e.g. sardines, tomatoes and varnish can, with a higher temperature of 1080 °C. Temperature is one of the most important physical parameters for obtaining optimal shot from metal rejects. Obtaining shot from metal waste could help the authorities in Conakry to develop a simple and rapid system to recover household waste.

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Conflicts of interest

The authors declare no conflicts interest.

Author contributions

Conceptualization, Methodology, Analysis and Writing: I.S.S; Review and Editing: D.Y. and I.S.S.; Supervision and Validation: A.Y.B. Authors have read and agreed to the published version of the manuscript.

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