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REMOVAL OF TOXIC METALS (LEAD &COPPER) FROM AUTOMOTIVE INDUSTRY WASTE WATER BY USING FRUIT PEELS

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Abstract— This project intends to find the potential of banana peels to act as water purifiers because of their low cost and because they don't have to be chemically modified in order to work. Banana peels are collected and dried. They are grained and sieved. The sieved peel particles are added into automotive industrial waste water. Tests are done for copper and lead before and after the adding process of banana. By this way the percentage of removal of copper and lead from automotive waste water by using banana peels is 93.52 and 87.44%. Banana processes, runoff from farms and industrial wastes can all put heavy metals, such as lead and copper in to waterways. Heavy metals can have adverse health and environmental effects. Current methods of removing heavy metals from water are expensive, parallel some substances used in the process are toxic themselves

Keywords— Industrial Waste, Automotive Waste Water, Banana Processes, Heavy Metals.

I. INTRODUCTION

1.1 Toxic Metals

Metal toxicity is the toxic effect of certain metals in certain forms and doses on life. Some metals are toxic when they form poisonous soluble compounds. Certain metals have no biological role, i.e. are not essential minerals, or are toxic when in a certain form. In the case of lead, any measurable amount may have negative health effects. Often heavy metals are thought as synonymous, but lighter metals may also be toxic in certain circumstances, such as beryllium, and not all heavy metals are particularly toxic, and some are essential, such as iron. The definition may also include trace elements when considered in abnormally high, toxic doses.

Toxic metals sometimes imitate the action of an essential element in the body, interfering with the metabolic process to cause illness. Many metals, particularly heavy metals are toxic, but some heavy metals are essential, and some, such as bismuth, have a low toxicity. Most often the definition includes at least cadmium, lead, mercury and the radioactive metals.[citation needed] Metalloids (arsenic, polonium) may be included in the definition. Radioactive metals have both radiological toxicity and chemical toxicity. Metals in an oxidation state abnormal to the body may also become toxic: chromium (III) is an essential trace element, but chromium (VI) is a carcinogen.

Toxicity is a function of solubility. Insoluble compounds as well as the metallic forms often exhibit negligible toxicity. In some cases, organ metallic forms, such as methyl mercury and tetraethyl lead, can be extremely toxic. In other cases, organ metallic derivatives are less toxic such as the cobaltocenium cation (it is dark purple solid that sublimes readily slightly above room temperature).

Decontamination for toxic metals is different from organic toxins: because toxic metals are elements, they cannot be destroyed. Toxic metals may be made insoluble or collected, possibly by the aid of chelating agents.

1.2 Heavy Metals

A heavy metal is a member of a loosely defined subset of elements that exhibit metallic properties. It mainly includes the transition metals, some metalloids, lanthanides, and actinides. Many different definitions have been proposed some based on density, some on atomic number or atomic weight, and some on chemical properties or toxicity. The term heavy metal has been called a "misinterpretation" in an IUPAC technical report due to the contradictory definitions and its lack of a "coherent scientific basis". There is an alternative term toxic metal, for which no consensus of exact definition

exists either. Depending on context, heavy metal can include elements lighter than carbon and can exclude some of the heaviest metals. Heavy metals occur naturally in the ecosystem with large variations in concentration. In modern times, anthropogenic sources of heavy metals, i.e. pollution, have been introduced to the ecosystem.

1.3 Copper

Copper is a chemical element with the symbol Cu (from Latin: cuprum) and atomic number 29. It is a ductile metal with very high thermal and electrical conductivity. Pure copper is soft and malleable; a freshly exposed surface has a reddish-orange color. It is used as a conductor of heat and electricity, a building material, and a constituent of various metal alloys.

The metal and its alloys have been used for thousands of years. In the romam era copper was principally mined on Cyprus, hence the origen of the name of the metal ascyprium (metal of cyprus), later shortened to cuprum. Its compounds are commonly encountered as coppersalts, which often impart blue or green colors to minerals such as azurite and turquoise and have been widely used historically as pigments. Architectural structures built with copper corrode, both by itself and as part of pigment.

Copper are essential to all living organisms as a trace dietary mineral because it is a key constituent of the respiratory enzyme complex cytochrome c oxidize. In molliscand crustacea copper is a constituent of the blood pigment hemocyanin, which is replaced by the iron-complexed hemoglobin in fish and other vertebrates. The main areas where copper is found in humens are liver, muscle and bone. Copper compounds are used as bacteriostatic substances, fungicides and wood preservatives.

Copper, silver and gold are in group 11 of the periodic table, and they share certain attributes: they have one s-orbital electron on top of a filled d-electron shell and are characterized by high ductility and electrical conductivity.

1.4 Advantages of Copper

Copper sheathing is water proof and resistant to ultraviolet light and many corrosive elements. Mineral insulated cable is approved by electrical codes for use in area with hazardous concentrations of flammable gas in air. Metal sheeting will not contribute fuel or hazardous combustion products to a fire, and cannot propagate a fire along a cable tray or within a building.

1.5 Disadvantages of Copper

While the length of the mineral insulated cable is very tough, at some point, each run of cabling terminates at a splice or within electrical equipment.These terminations are vulnerable to fire, moisture, or mechanical impact.

1.6 Lead

Lead is a chemical element in the carbon group with symbol Pb (from Latin: plumbum) and atomic number 82. Lead is a soft andmalleable metal, which is regarded as a heavy metal and poor metal. Metallic lead has a bluish-white color after being freshly cut, but it soon tarnishes to a dull grayish color when exposed to air. Lead has a shiny chrome-silver luster when it is melted into a liquid.

Lead is used in building construction, lead-acid batteries, bullets and shot, weights, as part of solders, pewters, fusible alloys and as a radiation shield. Lead has the highest atomic number of all of the stable elements, although the next higher element, bismuth, has a half-life that is so long (over one billion times the estimated age of the universe) that it can be considered stable. Its four stable isotopes have 82 protons, a magic number in the nuclear shell model of atomic nuclei.

If ingested, lead is poisonous to animals, including humans. It damages the nervous system and causes brain disorders. Excessive lead also causes blood disorders inmammals. Lke the element mercury, another heavy metal, lead is a neurotoxin that accumulates both in soft tissues and the bones. Lead poisoning has been documented from ancient rome, ancient Greece and ancient china.

Lead is a bright and silvery metal with a very slight shade of blue in a dry atmosphere. Upon contact with air, it begins to tarnish by forming a complex mixture of compounds depending on the conditions. The color of the compounds can vary. The tarnish layer can contain significant amounts of carbonates and hydroxyl carbonates. Its characteristic properties include high density, softness, ductility and malleability, poor electrical conductivity compared to other metals high resistance to corrosion and ability to react with organic chemicals

1.7 Advantages of Lead

Lead is very dense, and therefore a good shield, against gamma rays. Lead's nuclear properties allow it to prevent a positive void coefficient, which is difficult to prevent in large sodium fast reactor cores.

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As no electricity is recquired for the cooling after shutdown, this design has the potential to be safer than a water-cooled reactor.

1.8 Disadvantages of Lead

Lead and lead-bismuth are very heavy, requiring more structural support and seismic protection that increase building cost.

Lead is cheap and abundant, though bismuth is expensive and quite rare. A lead –bismuth reactor will require hundreds to thousands of tones of bismuth depending on reactor size.

1.9 Effects of Copper in Water

Copper is found throughout the human body, but a balance needs to be maintained to stay healthy. Health problems exist when you have an excess of copper or too little. Another health problem is when it fails to be released by tissues that surround certain organs of the body. One of the most important uses of copper is when it is combined with vitamin C to form a connective tissue called elastin.

Copper can be consumed as a supplement through foods such as meats, eggs, poultry, nuts and grains. When taken as a supplement copper can react in a negative way and produce side effects which may nullify any medication you may be taking. For example, women on birth control medication and estrogen replacement therapies already contain high levels of copper from their medications. When adding supplements, it may cause copper levels to raise to dangerous levels. Increased zinc supplements have also been linked to decreased absorption of copper in the intestines which leads to copper deficiency.

Some people who drink water containing copper in excess of the action level may, with short term exposure, experience gastrointestinal distress, and with long-term exposure may experience liver or kidney damage. People with Wilson's disease should consult their personal doctor if the amount of copper in their water exceeds the action level.

This health effects language is not intended to catalog all possible health effects for copper. Rather, it is intended to inform consumers of some of the possible health effects associated with copper in drinking water when the rule was finalized.

The major sources of copper in drinking water are corrosion of household plumbing systems; and erosion of natural deposits. Copper enters the water ("leaches") through contact with the plumbing. Copper leaches into water through corrosion – a dissolving or wearing a way of metal caused by a chemical reaction between water and your plumbing. Copper can leach into water primarily from pipes, but fixtures and faucets (brass), and fittings can also be a source. The amount of copper in your water also depends on the types and amounts of minerals in the water, how long the water stays in the pipes, the amount of wear in the pipes, the water's acidity and its temperature.

1.10 Banana Peels

A banana peel is the outer covering of the banana fruit. As bananas, whether eaten raw or cooked, are a popular fruit consumed worldwide, with yearly production over 145 million tonnes in 2011, there is a significant amount of banana peel waste being generated as well.

Banana peels are used as feedstock as they have some nutritional value. Banana peels are widely used for that purpose on small farms in regions where bananas are grown. There are some concerns over the impact of tannins contained in the peels on animals that consume them. Banana peels are used as feedstock for cattle, goats, pigs, poultry, rabbits, fish and several other species.

The specific nutrition contained in peel depends on the stage of maturity and the cultivar; for example plantain peels contain less fibre than dessert banana peels, and lignin content increases with ripening (from 7 to 15% dry matter). On average, banana peels contain 6-9% dry matter of protein and 20-30% fibre (measured as NDF). Green plantain peels contain 40% starch that is transformed into sugars after ripening. Green banana peels contain much less starch (about 15%) when green while ripe banana peels contain up to 30% free sugars.

II METHODOLOGY

Banana peels are collected and dried. They are grained and sieved. The sieved peel particles are added into automotive industrial waste water. Test are done for Copper and Lead before and after the adding process of banana peels

2.1. Test for Copper

The given copper salt solution is made up to 100 ml in a standard flask. Exactly 20 ml of the made up solution is pipette out into a clean 400 ml beaker. About 5 ml of dilute sulphuric acid is added followed by 20 ml of freshly prepared saturated solution of sulphurous acid. The solution is diluted to 100 ml and heated to boiling. 15 – 20 ml of 10% freshly

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prepared ammonium thiocyanate is added in drops with constant stirring till the reagent is in slight excess. The supernatant liquid must be colorless. The precipitate is allowed to stand overnight, and tested for completion of precipitation by adding the ammonium thiocyanate reagent along the sides of the beaker.

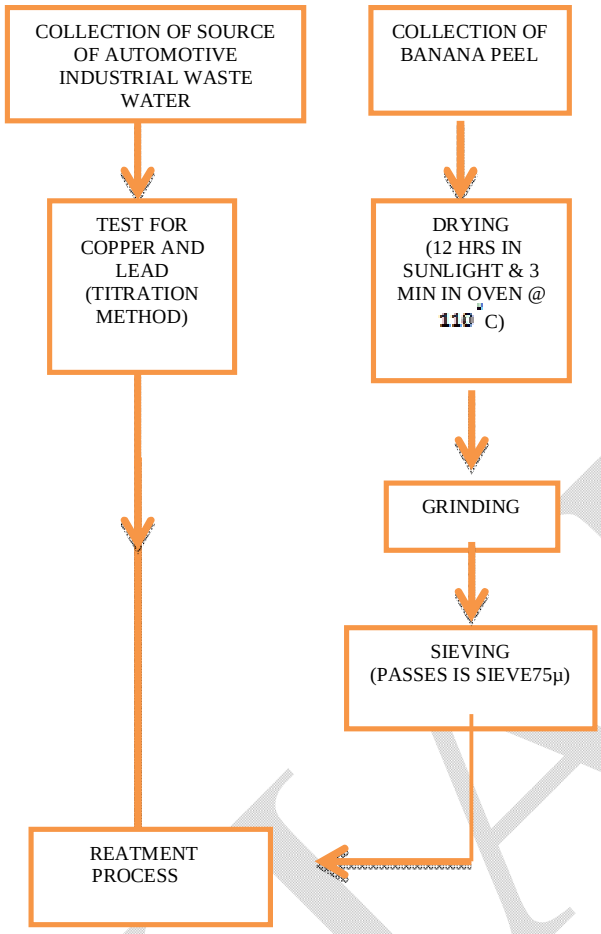

Fig 1: Test for Copper

The supernatant liquid is filtered through a previously cleaned, dried and weighed with cold water containing 1ml of 10% ammonium thiocyanate solution and 5 drops of saturated sulphurous acid solution per 100ml of water. The precipitate is finally washed with 20% alcohol several times to remove ammonium thiocyanate.

The precipitate is dried to constant weight at 110- C and weighed as cuprous thiocyanate. A duplicate experiment is conducted simultaneously. From the weight of cuprous thiocyanate obtained, the amount of copper present in the whole of the given solution is calculated.

2.2. Test for Lead

The given lead salt solution is made up to 100 ml in a standard flask. Exactly 20 ml of this solution is pipette out into a clean 400 ml beaker, provided with a cover glass and a glass rod for stirring. The solution is diluted to 100ml and boiled. To the hot solution 20ml of dilute sulphuric acid is added in drops with stringing. The precipitate is heated on a low flame for about 30 minutes and allows settling.

The clear supernatant liquid is then tested for completion of precipitation by adding dilute sulphuric acid along the sides of beaker. The clear liquid is then filtered through a whatmann No .40 filter paper. The precipitate is repeatedly washed with hot distilled water,filtered ,till the washings are free from chloride and sulphate (test with silver nitrate and barium chloride) . Then the precipitate is transferred into the filter paper. Any particles sticking to the sides are removed using a policeman. After the filtration is over,the precipitate is dried with the funnel in the air oven.

Meanwhile a silica crucible is heated, cooled in a desiccator and weighed. The filter paper is removed from the funnel and it is folded into a small packet taking care that all open ends are closed. The packet is then placed in ac crucible upside down and partly covered with the lid. The crucible is then heated slowly till the filter paper chars, taking care that the ash does not fly off. The crucible is then heated strongly till no more black prticles are left in the crucible. Any carbon particles on the lid are removed by directly showing it into the flame. Heating is continued for further 20 minutes. The crucible is cooled in a desiccator and weight. The process of heating, cooling and weighing is repeated to constant weight. A duplicate experiment is conducted simultaneously. From the weight of the lead obtained, the amount of lead present in the whole of the given solution can be calculated

III TEST REPORT

Sample description: Effluent from automotive industry.

Tested for: Efficiency of copper and lead removal.

Table.1 Test report

MATEL	Before concentration	After concentration
Copper	5.1mg/l	0.33mg/l
Lead	4.3mg/l	0.45mg/l

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Efficiency calculation:

Percentage of removal of copper

= initial conc. – final conc.× 100 % initial conc.

= (5.1 – 0.33)×100/5.1

= 93.52 %

Percentage of removal of copper

= initial conc. – final conc.× 100 % initial conc.

= (4.3 – 0.54)×100/4.3

= 87.44 %

IV. RESULT

Percentage of removal of copper from automotive waste water by using banana peels is 93.52%.

Percentage of removal of lead from automotive waste water by using banana peels is 87.44%.

V. CONCLUSION

Banana peels act as a good bio-sorbent material for removal of toxic metals from automotive industrial waste water. It is well known purification process for the economic medium. It is seen that through this process highest removal of copper 93.52 and lead 87.44% is obtained. Since, this process leads to the accumulation of the toxic substances in the environment this type of process is of high importance where high investment cannot be made. Thus, this type of projects is of national importance for the greener nation, sustainable future and to maintain the ecological balance by maintaining the aquatic life as well as environmental factors.

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