



# Effect of aluminum in the macroinvertebrates population

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## ABSTRACT

Alzheimer's disease has been increasing in the twenty-first century society. It is believed that aluminum is one of the factors causing this condition. The Environmental Health Criteria document for aluminum states that there is a positive relationship between aluminum in drinking-water and Alzheimer disease (AD). According to 2008 Mortality Statistics the towns with a higher incidence of death related to Alzheimer in Puerto Rico are San Juan, Carolina and Bayamon and the towns with a lower incidence are Loiza, Luquillo and Maunabo. The rivers that supplies water for those towns were chosen for the water sampling. This investigation aims to determine the effect of aluminum ion found in the streams have in the macroinvertebrates population and the use of macroalgae for its removal. A site assessment, water and macroinvertebrates samples was done. Finally the detection of aluminum in the samples was completed by colorimetric method EDTA Complexometric. The absorption of the aluminum, both as the aluminum substance and the river water samples made with *Glacilaria spp.* and *Sargassum spp.* The algae absorbed 67 and 64 % of the aluminum present in the solution. The macroinvertebrates

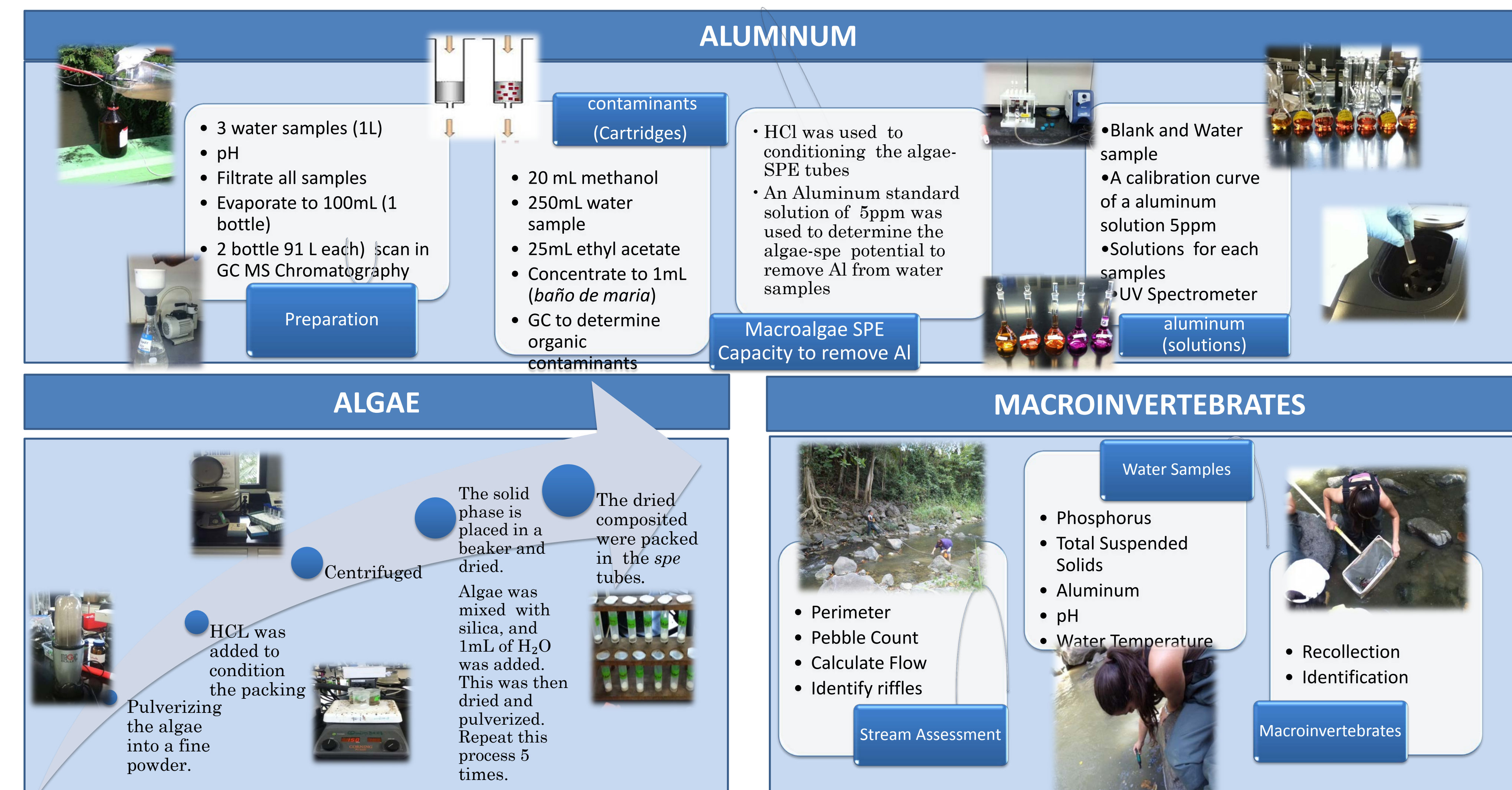


Images shows Diptera, Coleoptera, and Gastropoda respectively. Source: [http://wikieducator.org/Maracuto\\_Creek\\_46](http://wikieducator.org/Maracuto_Creek_46)

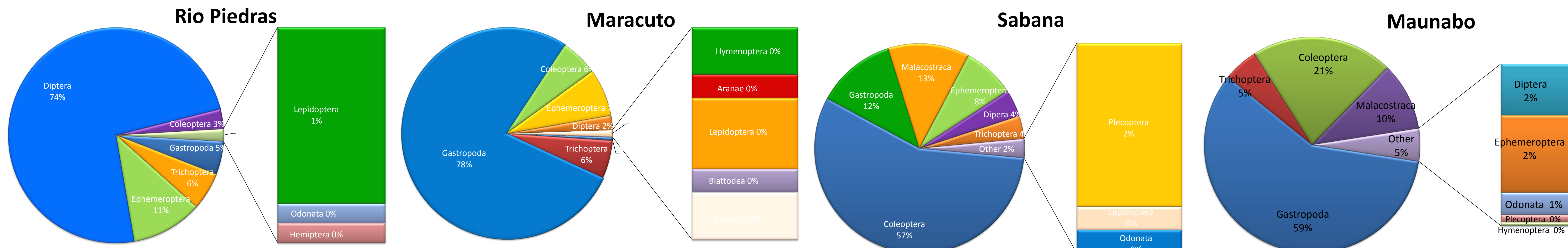
## INTRODUCTION

- Aluminium is the most abundant metallic element and constitutes about 8% of the Earth's crust. It occurs naturally in the environment as silicates, oxides, and hydroxides, combined with other elements, such as sodium and fluoride, and as complexes with organic matter.
- Epidemiological studies suggest that a relationship exists between Aluminum (Al) and Alzheimer disease (AD) involving relative risks for population exposed to Al concentrations in drinking water higher than 0.1mg/L.
- Macroinvertebrates are insects that are known for their lack of vertebrate. They mostly habit aquatic ecosystems and are generally sedentary. They are considered bio indicators. This factor allows us to determine the quality of the water by defining the physical, chemical and biologic conditions of the stream.
  - ✓ How is macroinvertebrates populations affected by the presence of aluminum in the streams?
- Because marine environments are normally scarce in these metals, some marine algae especially have developed efficient mechanisms to gather these heavy metals from the environment and take them up.
- Algae have different type of uses when it comes to the term of immobilization; one way to immobilize algae is with silica. A great way to use immobilized algae is by absorbing liquid pollutants. (Hameed & Hammouda, 2007). In recent studies we demonstrated that immobilized algae were effective alternative to remove organic pollutants from water.
  - ✓ Can the immobilized algae, *Glacilaria spp.* and *Sargassum spp.*, simultaneously remove the organic pollutants and the aluminum present in water samples?

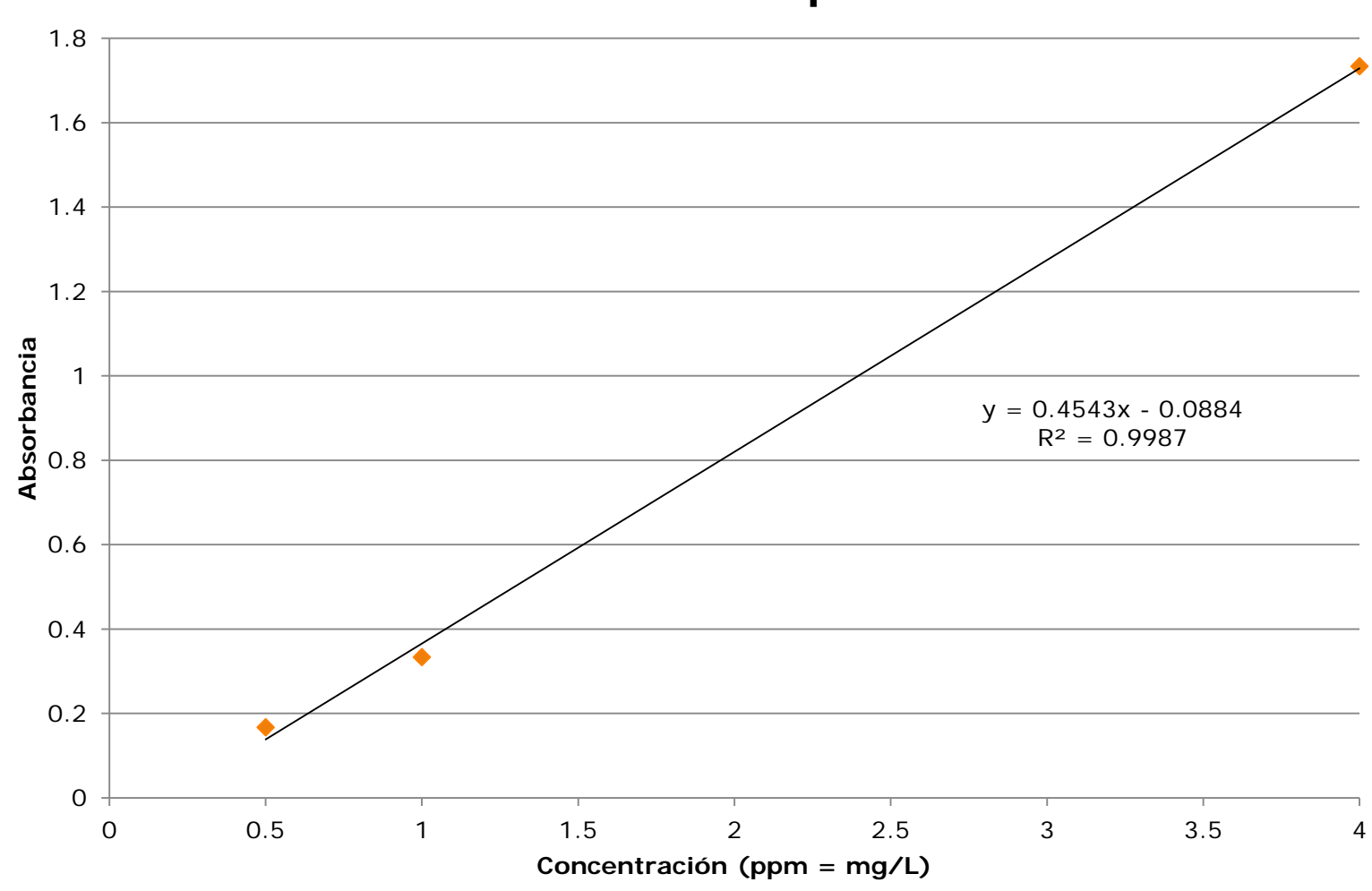
## METHODOLOGY



## RESULTS



Calibration Curve for the Determination of Al in Water Samples



Algae	Absorbance (±0.0001)	Al Absorbed (mg/L)	Residual Al Concentration (ppm = mg/L)	Absorption Capacity (µg Al/g dry algae)
<i>Glacilaria</i>	0.6667	3.34	1.66	33
<i>Sargassum</i>	0.7333	3.20	1.80	32

Sites	Absorbance (±0.0001)	Concentration (ppm = mg/L)
Río Grande de Loiza	0.2667	0.078
Carraizo	0.3000	0.085
Pitahaya	0.2667	0.078
Maunabo	0.2667	0.078
Blanco	0.4000	0.175

- Abundance in Gastropoda, Diptera and Coleoptera populations
- High levels of TSS in Maracuto and Rio Piedras River
- High levels of Phosphorus in Rio Piedras
- Major organic compounds from the sites are:
  - Ethylbenzene occurs from the use of consumer products, gasoline, pesticides, solvents, carpet glues, varnishes, paints, and tobacco smoke.
  - Phenol used primarily in the production of nylon and other synthetic fibers.
  - Hexadecane is from diesel.
- High levels of pH were found in the Maunabo River with 9.0. Other pH were relatively normal like Maracuto and Sabana with 8.0 and Rio Piedras with 8.5.



## CONCLUSIONS

- The immobilized algae, *glacilaria* and *sargassum*, absorbed 67 and 64 % of the aluminum present in the model solutions.
- *Glacilaria spp.* packing was more effective removing the aluminum present in the solutions.
- According to our previous and current research results we can conclude that macroalgae packing are a green and cheap alternative to remove simultaneously organic pollutants and Aluminium from water samples.
- Abundance of Gastropoda, Diptera and Coleoptera populations indicates polluted streams.
- Macroinvertebrates were not impacted at a great scale by the levels of aluminum found.
- High levels of Phosphorus and TSS affect not only the quality of the water, but the organisms that lives there.

