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CARBAMAZEPINE DEGRADATION WITH ISOLATED BACTERIAS OF MACHÁNGARA RIVER IN QUITO - ECUADOR

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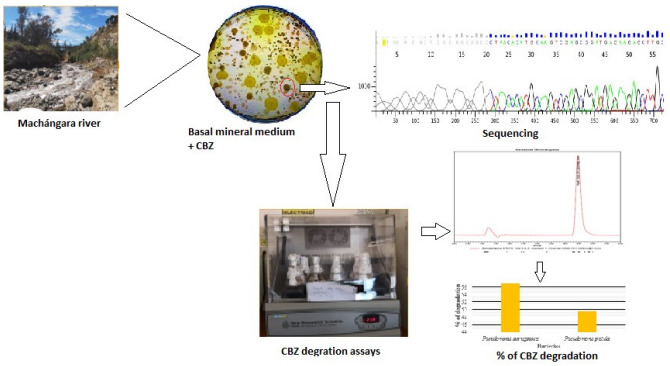
Graphical Abstract



Abstract.

Carbamazepine (CBZ) is an antiepileptic-psychiatric drug, which is eliminated directly in water effluents by urinary or fecal routes; causing toxicity and mutagenic effects in living beings.

According to the study by Voloshenko, A, et al (2015), in Ecuador carbamazepine is one of the most persistent emerging pollutants, which despite going through conventional wastewater treatments, it cannot be eliminated. Therefore, there is evidence of the need to develop investigations of alternative degradation processes, such as biological treatments that incorporate microorganisms that use the contaminant as a carbon source.

In this work, two sampling points were selected in the Machángara River to isolate microorganisms able to consume carbamazepine as carbon source. These points were selected, due to their greater concentration of emerging pollutants. Water samples were characterized physically - chemically and microbiologically, presenting values outside the maximum permissible limits for fecal and total coliforms, which make this resource not suitable for human

	consumption. Microorganisms capable of using carbamazepine as a carbon source were also isolated and molecularly identified. *For degradation tests, two bacteria belonging to genus Pseudomonas were initially selected, one isolated from the water source and an ATCC certified bacterium; observing that the best treatment was with Psedomonas aeruginosa ATCC 9027, 2% v / v of inoculum, 30 ° C, with 15 ppm of CBZ for 37 days of treatment.*

Introduction *(optional)*

Water is an important resource for living beings, which has been affected by pollutants as emerging contaminants, these are pollutants composed of different chemical nature, considered as dangerous, due to their high persistence and toxicity in the environment[2].

In Ecuador, these pollutants have been detected in the San Pedro, Guayllabamaba and Esmeraldas rivers. Among these, there is carbamazepine, a drug used to treat epilepsy and psychiatric problems, which is highly persistent in the north Machángara river in Pichincha province [2], despite passing through the San Mateo residual water plant treatment. Therefore, we opted for the use of microorganisms capable of degrading carbamazepine and reducing the negative effects on living beings [1,2 ,3].

Materials and Methods *(optional)*

Water samples were taken from two points north of the Machángara River, which were characterized physical-chemical (COD, BOD, pH, conductivity and total nitrogen) and microbiologically (gram staining, catalase test and oxidase). Bacteria with carbamazepine degrading capacity were isolated and molecular identified. *Pseudomonas putida* and *Pseudomonas aeruginosa* ATCC 7029 were selected for degradation tests at 15, 50 and 100 ppm, with variation in temperature of 25 and 30 ° C, with different inoculum percentages (2%, 5% v / v) and on evaluation time of 15, 35, 37 days. To assess the degradation the contaminant was quantified in HPLC, with a mobile phase composed of the ratio water: methanol: acetonitrile (50:25:25), at a retention time of 8.0 minutes.

Results and Discussion *(optional)*

The physical - chemical analysis of the water samples showed values of COD, BOD, ph, conductivity and total nitrogen within the range of the maximum permissible limits of Ecuadorian legislation and the environmental quality standard. But in microbiological characterization, for fecal and total coliforms the values were higher than the permissible limits, so this water is not suitable for human consumption [2] [4].

From the samples of contaminated water of the Machángara River, four bacterias were isolated and identified, all of which were bacillus gram negative, oxidase and catalase positive in aerobic conditions [5]. In the molecular identification by sequencing, the microorganisms were *Enterobacter cancerogenus* and *Enterobacter ludwigii* (CZ1), and *Pseudomonas putida* (CBZ2 to CBZ4).

The degradation tests were evaluated with the isolated bacterium *Pseudomonas putida* and *Pseudomonas aeruginosa* ATCC 9027, for presenting a high capacity to adapt to a variety of environmental conditions and their ability to activate their control cellular metabolism [1]. Both bacteria showed no significant difference in degradation.

With the three concentrations of carbamazepine evaluated (15, 50 and 100 ppm), it was determined that at a lower concentration, the degradation was better, because of high concentrations become toxic to microorganisms [2]. Temperature was another factor studied (25 and 30 ° C), however it did not significantly influence degradation; unlike time, which indicated that the most suitable treatment was for 37 days, when presenting a longer adaptation time to the contaminant before degrading it [3].

Conclusions *(optional)*

In the waters of the Machángara River there are bacteria with a potential application in carbamazepine degradation tests.

Carbamazepine at low concentrations (15ppm) can be degraded by *Pseudomona putida* and *Pseudomona aeruginosa* ATCC9027, under aerobic conditions.

Carbamazepine is a persistent degradation drug against conventional treatments, so the use of microorganisms can be an alternative by having a high capacity to metabolize organic compounds.

References *(mandatory)*

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