

THE ELIMINATION OF IBUPROFEN BY OZONE TREATMENT

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Introduction

- It is known that the waters of rivers, lakes and seas contain a wide range of polluting compounds that they can reach the drinking water provided to citizens if they haven't received adequate pre-treatment for their total elimination.
- One family of compounds that are becoming very important in the investigation are drugs: Analgesic, anti-inflammatory, contraceptives, antibiotics and various products that fill our medicine cabinets end in the environment to be introduced into the wastewater through excretion, manufacturing processes and uncontrolled dumping of expired drugs (Santos Morcillo JL, 2006).
- The problem is present when it isn't possible to eliminate these pharmaceutical residues when these waters are in contact with conventional treatment of the wastewater treatment plant and many of these compounds end up in rivers, lakes, oceans, aquifers and the end, in very small quantities, it ends up in different households (C. Zwiener et al, 2000).
- This work studies the degradation of ibuprofen in surface waters for human consumption by ozone treatment. The ibuprofen was selected as a composite of study due to the significant consumption of this compound by the population and their presence in the aquatic environment.
- The degradation tests were carried out in a pilot plant which was circulated water flow of 1,300 l/h with a concentration ranging between 0.1 and 10 mg/l of ibuprofen. The identification of the compound was made using high performance liquid chromatography (HPLC) and detection by UV at 220 nm.
- In this study have achieved reductions of ibuprofen in water up to 90% with half an hour application.

Methods

CHEMICALS AND MATERIALS

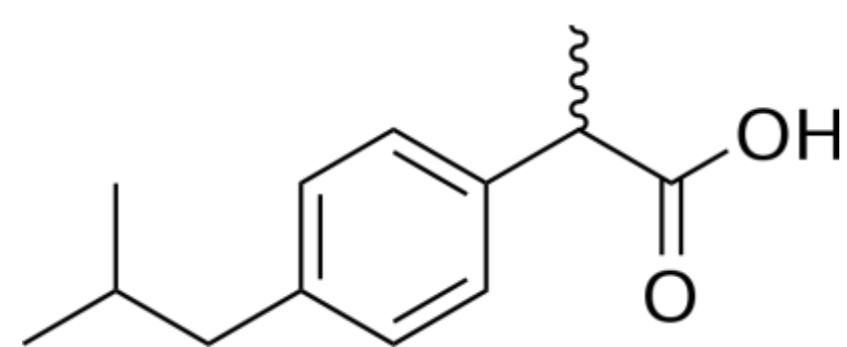


Figure 1: Chemical structure of IBP

- Molecular Mass : 206,26 g/mol
- Chemical structure: C₁₃H₁₈O₂
- Composition: > 98 % purity

SAMPLE TREATMENT

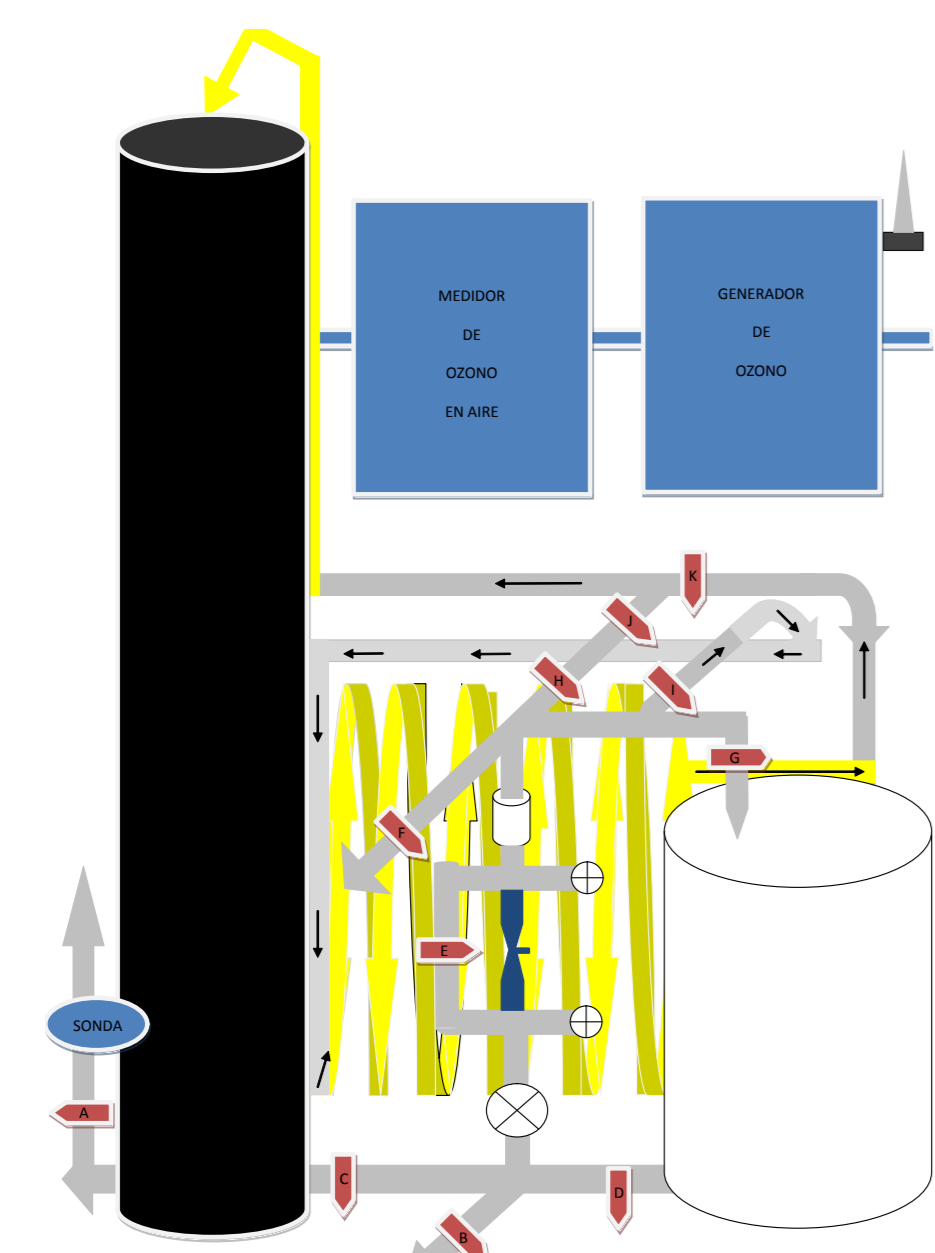


Figure 2: Pilot plant

- Plant Elements: column of residence, maze of mixing, venturi device, ozone generator, ozone meter in water and air, and water and air flow meter.
- Sampling: the beginning and end of each treatment
- Working conditions:

			Comments
Workload	20	litres	Ultrapure Water
[Contaminant]	1	ppm	Dissolved in 0,3 ml of solution of Methanol/H ₂ O
Q air	15	l/min	
Q water	1200	l/h	
[Ozone] gas	12 2	gN/m ³	

Table 1: Working conditions

ANALYSIS

- Method: Mendez Arriaga F. (2009) y Zwiener et al, (1999)
- Column: Teknokroma C18 (250 x 4,60 mm i.d., 5 µm)
- Eluents: Methanol/H₂O, 70:30

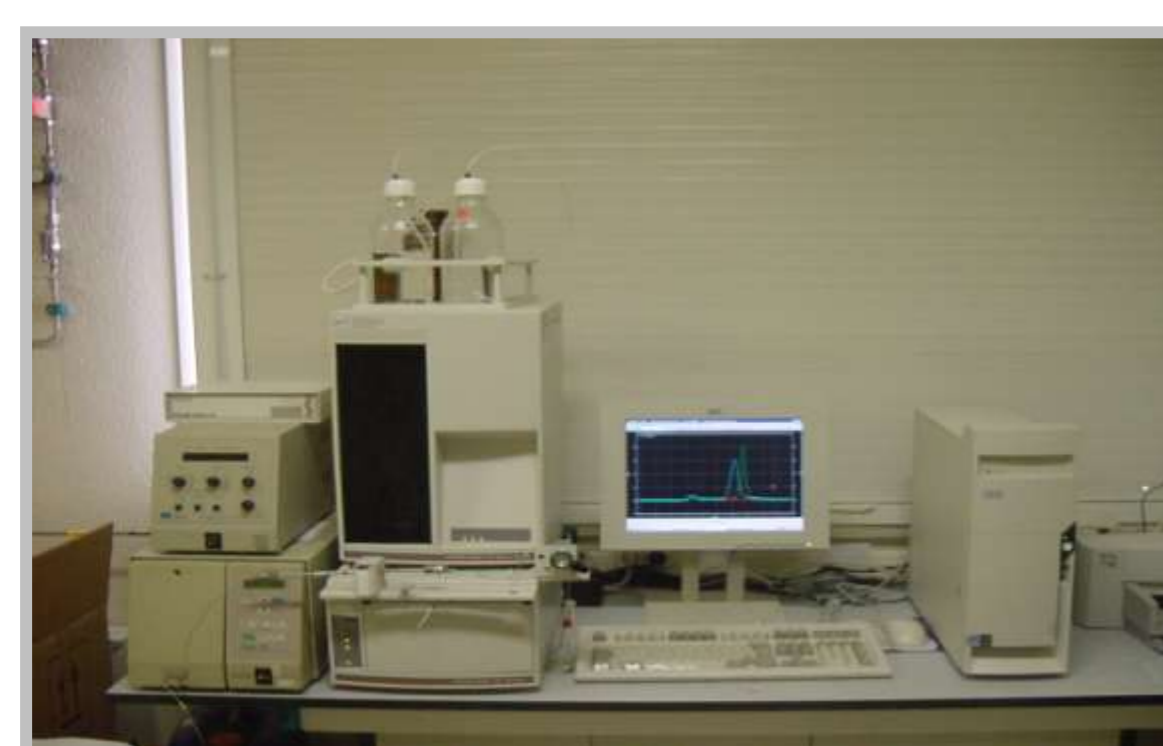


Figure 3: Instrument of HPLC

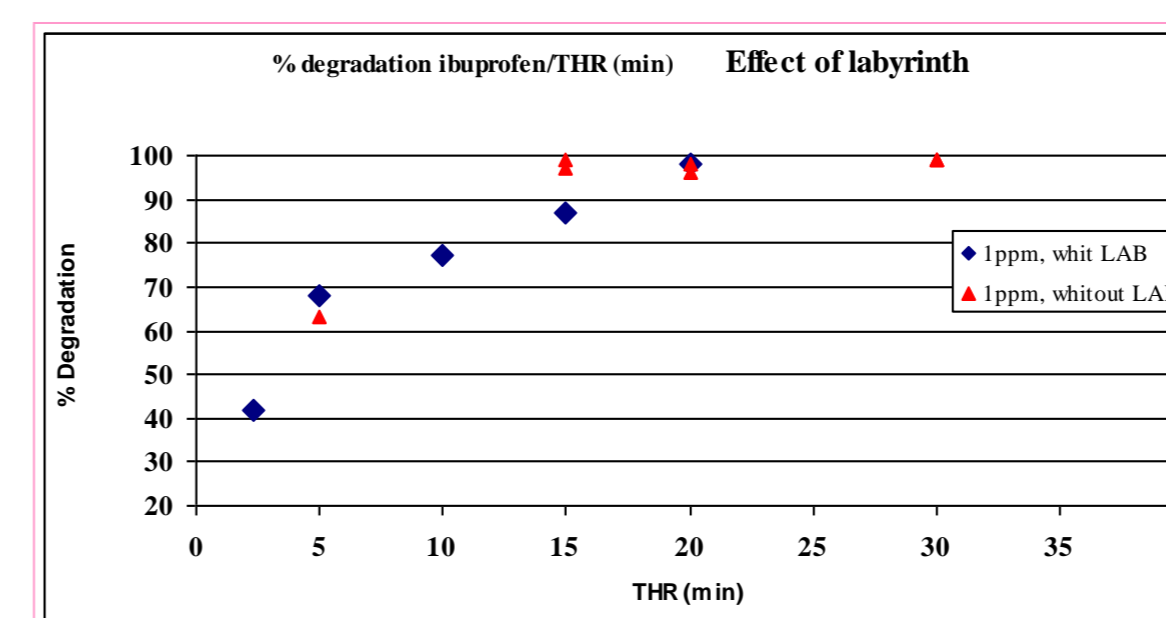
Time (min)	Flow rate (mL/min)	% A	% B
0	1,5	70	30
20	Stop data	70	30
Workflow		1 ml/min	
Sample volume		20 µl	

Table 2: Method used in HPLC

- Detector U.V.: λ_{ex} = 220 nm
- SPE: The samples are
- The samples are passed through a SPE cartridge (pH = 2) with the help of a gentle vacuum. The flow rate in the cartridge was 10 ml/min. Previously, the cartridges were conditioned by passing them 8 ml of methanol, 8 ml of acetone and 15 ml of water MilliQ. After, we dried the cartridge with nitrogen and eluted the analytes with four fractions of 2 ml of methanol. The solvent was evaporated with a gentle stream of nitrogen and the residue immediately, was dissolved in 1 ml of solution 70A/30B
- Conservation Condition: -80 °C

Results and Discussion

Figure 4 : % degradación IBP/ THR (min)



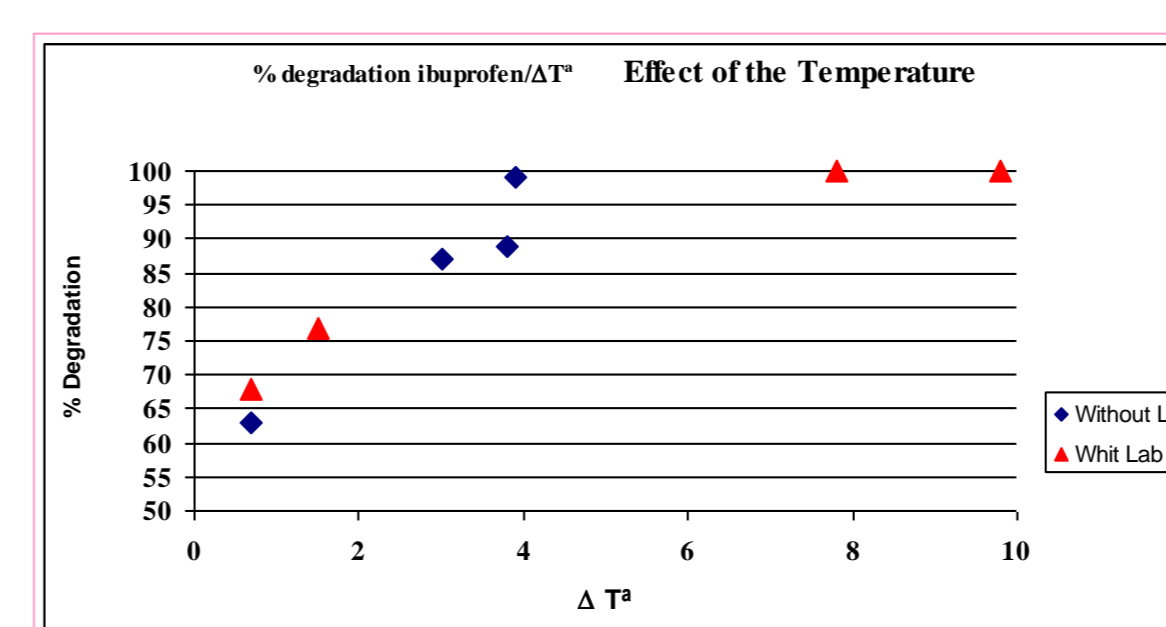
- Represent the percentage of degradation of ibuprofen and hydraulic retention time, working with and without reaction maze.

- The results in the degradation process can be seen in the table 3:

Degradation Time (min)	Use of the labyrinth	Performance
< 10	✓	↑
= 15	*	↑
> 20	* / ✓	Indiferent

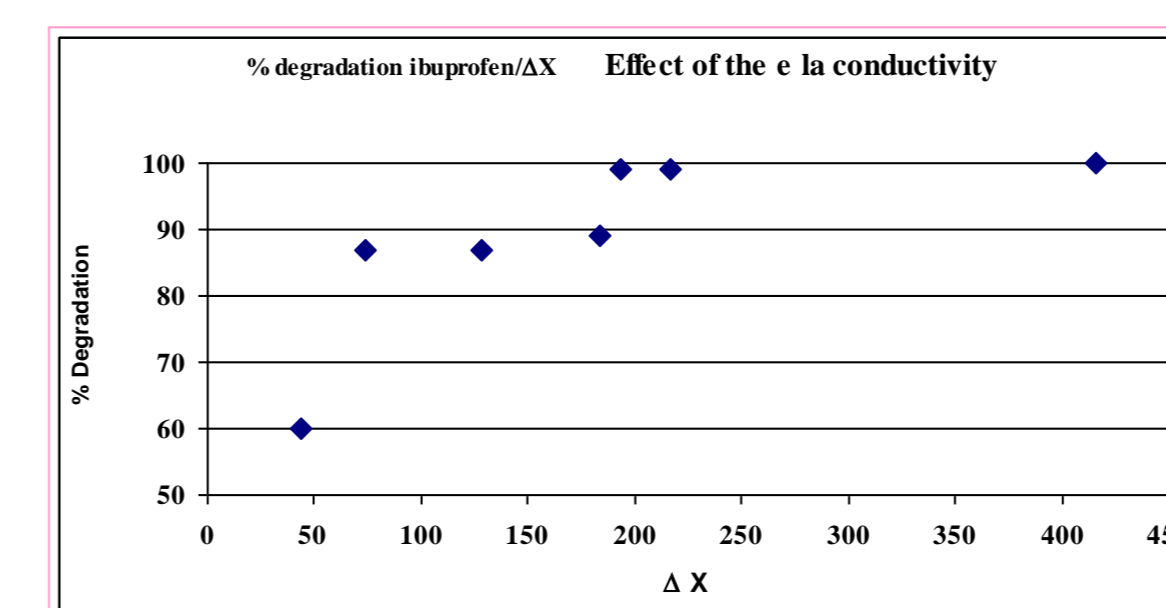
Table 3: Conclusion Labyrinth/%Degradation

Figure 5: % degradación IBP/ Δ Temperature



- Small increases in temperature (below 4° C) in the reactor improves the degradation of the drug, both when working use the labyrinth like without it.

Figure 6: % degradación IBP/ Δ Conductivity



- Conductivity increases up to 200 µS/cm are associated with consistent increases in the rates of degradation of ibuprofen to 99%, when we work using the labyrinth with the optimal THR.

Conclusions

- It is possible the primary removal of Ibuprofen dissolved in water by ozone treatment.
- The use of the labyrinth in the system helps to achieve higher returns to low THR (<10 min). However for higher retention times the labyrinth doesn't improve the efficiency of oxidation.
- Small variations in temperature and conductivity during treatment predicted a higher rate of degradation.

References

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