Cocaine degradation by *Pseudomonas stutzeri*: an alternative approach for the final disposal of a dangerous solid waste

C.A. Díaz, E. Restrepo, W. F. Garzón and J.C. Higuita
Overview

• Introduction
• Methods
• Results and discussion
• Conclusions
• References
Introduction

COCAINEN
Key figures

Global cultivation
change from previous year
Most recent estimate (2014) 132,300 ha
105,300 x
2014

Global seizures
change from previous year
stable
2014

Global production
change from previous year
746-943 tons
2014

Global number of users
18.3 million
2014

Note: Cocaine seizures are mostly of cocaine hydrochloride (of varying purity), but also include other cocaine products (paste, base and "crack").
Introduction

Quantities of cocaine seized, by region, 1998-2014

Quantities of cocaine seized in North America and prevalence of past-year cocaine use in Canada and the United States, 2002-2014

Source: Responses to the annual report questionnaire, the United States National Household Survey on Drug Use and Health and the Canadian Tobacco, Alcohol and Drugs Survey (CTADS) 2013.

Note: Data for 2002 have been used as baseline data, as the United States National Household Survey changed its methodology several times between 1998 and 2002.
In 2016, Colombia seized 308 metric tons, 59 more than in all 2015. Seizure figures in Colombia in a decade reached 2,000 tons.

The Narcotics Division of the National Police of Colombia has already seized 130 tons in 2017.

6.8 kg per hectare where four harvests are exceeded per year.

Production and refinement of cocaine
Objective

The aim of this research was to grow and adapt *Pseudomonas stutzeri* in a minimum medium using cocaine hydrochloride as the only carbon source as an alternative disposal method to reduce the contamination of this drug of abuse.
General Method

Cryopreserved strains

Incubator 32°C, 150 rpm

Inoculate each strain separately in salt medium

Spectrophotometry analysis

Bacterial growth kinetics and quantification by HPLC-MS

Reactivation of strains and adaptation to test substrate
Methods
Methods
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile Phase</td>
<td>Mixture of the dibasic sodium phosphate solution 0.05mol L-1 pH 8.0 and acetonitrile (70:30 v/v).</td>
</tr>
<tr>
<td>Mode</td>
<td>Gradient</td>
</tr>
<tr>
<td>Detector</td>
<td>UV 235nm</td>
</tr>
<tr>
<td>Column Flow</td>
<td>1,0 mL/min</td>
</tr>
<tr>
<td>Rt Cocaine</td>
<td>1,802 min</td>
</tr>
<tr>
<td>Work temperature</td>
<td>RT</td>
</tr>
</tbody>
</table>
Results

Several strains were evaluated and the one that showed the best adaptation was *P. stutzeri*. 
Growth kinetics

The first growth was between 12 to 16 h, while successive growths reduced the time growth between 4 to 12 h.
Chromatographic results of cocaine consumption by *Pseudomonas stutzeri*

Cocaine Control 99% purity

Real sample of cocaine at 2000 ppm, t=0,0 h

Real sample of cocaine at 2000 ppm, t= 24h

There was a 50% removal in the cocaine concentration in 24h
Conclusions

- There was a good adaptation of *P. stutzeri* to the cocaine substrate as the only carbon source in a saline medium.
- The major adaptation was at 2000 ppm.
- The removal of cocaine, so far, was 50%.
- The adaptation process of *P. stutzeri* to use cocaine as carbon source, might help as an alternative destruction method of this substance.
- Further studies must be conducted in order to adapt microorganisms to higher concentrations of cocaine and also to obtain better removal values.
References


Research Group in Chemical, Catalytic and Biotechnological Processes, Laboratory Group of Biological and Molecular Sciences
Research Group of the International Center for Strategic Studies Against Drug Trafficking - Colombia