
Uptake and bioaccumulation of Cd in cacao beans in areas impacted by oil activities in Ecuador

Fiorella Barraza*¹, Eva Schreck^{†1}, Thibaut Lévêque¹, Gaelle Uzu², Fausto Lopez¹, Jenny Ruales³, and Laurence Maurice¹

¹Géosciences Environnement Toulouse (GET) – Observatoire Midi-Pyrénées, Institut de recherche pour le développement [IRD] : UR234, Université Paul Sabatier (UPS) - Toulouse III, CNRS : UMR5563, Université Paul Sabatier [UPS] - Toulouse III – Observatoire Midi-Pyrénées 14 Avenue Edouard Belin 31400 Toulouse, France

²Laboratoire d'étude des transferts en hydrologie et environnement (LTHE) – Institut National Polytechnique de Grenoble (INPG), Université Joseph Fourier - Grenoble I, INSU, OSUG, CNRS : UMR5564, Institut de recherche pour le développement [IRD] : UR012 – ENSHMG - Domaine Universitaire 1023-1025 Rue de la piscine - BP 53 38041 GRENOBLE CEDEX 9, France

³Escuela Politencia Nacional (EPN) – Ladron de Guevera E11-253, Quito 170517, Ecuador

Abstract

In Ecuador, oil and gas exploitation in the northeastern Amazon and refinery along the Pacific coast has already caused serious environmental and social impacts.

Both regions have vast extensions of cacao crops, an exportation product recognized worldwide for its special flavor, the fine aroma. Due to their toxicity, metals and hydrocarbons released during oil production not only impact ecosystems, but also represent potential health risk to the populations after inhalation or plants ingestion.

This study aims to assess metal uptake by cacao beans in both regions impacted by oil activities and the potential health risks involved. Cacao and soil samples (at different depths) were collected in impacted regions in the Amazon basin (oil production) and in Esmeraldas (refinery). Soil physico-chemical properties (pH, CEC, organic carbon) were determined. Cacao beans were separated from the entire pod in order to focus on the consumed tissue. All samples were freeze-dried and grounded before acid digestion and metal content analysis by ICP-MS. Metal phytoavailability was assessed in soils by CaCl₂ extractions. Human bioaccessibility after ingestion was investigated by the BARGE *ex vivo* test in cacao beans and topsoils.

Preliminary results show that among the investigated metals, Cd is bioaccumulated in cacao beans (about 1 mg kg⁻¹) reaching values higher than the critical level (0.6 mg kg⁻¹) established by Ecuador and the European Union. Even its low content in soils (< 0.5 mg kg⁻¹), Cd remains phytoavailable. Between 40 and 60% of the total Cd content is bioaccessible by ingestion, suggesting potential risks for human health. However, Cd origin in soils (natural sources, fertilizers or gas emissions) remains unclear.

The global study of socio-environmental impacts of oil activities in Ecuador takes place in the frame of the French ANR-MONOIL Project. Further studies are in progress to assess more precisely local population's exposure to metals-PAHs cocktails.

*Speaker

[†]Corresponding author: eva.schreck@get.obs-mip.fr

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