Tropentag, September 14-16, 2022, hybrid conference

"Can agroecological farming feed the world?
Farmers' and academia's views"

Recycling resources from coffee by-products via hydrothermal conversion for sustainable coffee farming in Vietnam

Huyen Chau Dang[1], Judy Libra[2], Christina Dornack[3], Marcus Fischer[4]

[1]*Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Post Harvest Technology, Germany*
[2]*Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Potsdam, Post Harvest Technology,*
[3]*Institute of waste management and circular economy, Technical University of Dresden,*
[4]*Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Potsdam, Post Harvest Technology, Germany*

Abstract

Vietnam is the world's second-largest coffee-producing country, depending on over half a million smallholder households, most with less than 2 hectares, to produce 95 % of its coffee production (Anh et al., 2019). However, Vietnam's coffee sector is facing challenges to remain competitive: 1) world market pressure to improve product quality, 2) climate change with threats of drought, pest, and disease attack, 3) the need to promote product diversification. Measures to meet these challenges range from expanding the wet-processing capacity of coffee berries, to improving the resilience of the growers through agroecological farming and ensuring that sustainable production standards are met throughout the value chain. While wet-processing can make farmers and the whole value chain less dependent on weather conditions and produce higher quality coffee beans, new challenges arise from the centralised production of large amounts of by-products in these plants. Approaches and technical methods to support local recycling of the nutrient and carbon resources in the coffee by-products are required in keeping with the agroecological farming principles. The conversion of the coffee by-products to stabilised carbon-rich materials that can be returned to the coffee farmers as a soil improver and fertiliser is the focus of this study.

The hydrothermal carbonisation process (HTC) was used to enhance the properties of coffee by-products for carbon and nutrient recovery. In the HTC process, the by-products are thermally converted to a solid, hydrochar, and a liquid, the process water. Experiments with various waste streams from a coffee processing plant in Vietnam were conducted to determine the influence of HTC conditions on the recovery efficiency for carbon and nutrients in the products. The goal was to optimise the HTC process settings and post-processing steps to yield products that can be used as soil improvers for coffee plantations. The product composition was characterised and the values were compared to European and international standards for soil additives. The overall recovery efficiency for carbon and nutrients caused by the process steps was evaluated. The technical feasibility of the proposed process combination with HTC will be discussed based on its potential costs and benefits for the coffee value chain.

Contact Address: Huyen Chau Dang, Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Post Harvest Technology, Max-Eyth-Allee 100, 14469 Potsdam, Germany, e-mail: hdang@atb-potsdam.de

Keywords: Carbon and nutrient recovery, coffee farming, coffee value chain, hydrothermal carbonisation, sustainability