Potential of by-products from primary coffee processing as source of biofuels

Bilhate Chala, Sajid Latif, Joachim Müller
Universität Hohenheim, Institute of Agricultural Engineering, Tropics and Subtropics Group (440e), Stuttgart, 70599, Germany

Problem and Objective

- Coffee is second most traded legal commodity next to petroleum. Millions of people from developing countries rely their livelihood on coffee production
- Primary coffee processing, either in wet or dry method, generate almost half the weight of the coffee cherries as by-products, mostly seen as waste and dumped, which causes environmental problems
- This study intends to characterize by-products from primary coffee processing as source of biofuels

Materials and Methods

- In January 2015, field visit on primary coffee processing was done in Jimma Zone, one of the highest coffee growing area in Ethiopia. The by-products were collected from coffee processing facility, sun dried, packed and transported to University of Hohenheim, Stuttgart, Germany
- Samples were prepared for lab analysis according to standard methods and the characterization was done in University of Hohenheim, following respective standard methods/protocols

Fig. 1 Left to right, fresh coffee cherry, pulp and husk

Result

Parameters	Pulp	Husk	Mucilage	Parchment
NDF	55.6 ± 1.4	64.0 ± 1.1	37.7 ± 1.2	96.8 ± 0.3
ADF	47.1 ± 0.1	49.5 ± 0.0	36.9 ± 0.6	76.9 ± 0.2
ADL(Lignin)	15.5 ± 1.6	17.5 ± 1.6	5.0 ± 0.3	32.2 ± 0.0
Soluble cell contents	44.4 ± 1.4	36.0 ± 1.1	62.3 ± 1.2	3.2 ± 0.3
Crude Fibre	24.8 ± 1.2	39.9 ± 0.1	19.4 ± 0.4	76.9 ± 0.3
Ash content	11.7 ± 0.2	7.2 ± 0.1	14.9 ± 0.1	0.5 ± 0.0
Organic total solid (oTS of TS)	88.3 ± 0.2	92.9 ± 0.1	85.1 ± 0.1	99.6 ± 0.0
Volatile matter	72.5 ± 0.2	76.3 ± 1.5	75.7 ± 0.5	85.8 ± 0.3
Fixed carbon	15.8 ± 0.4	16.5 ± 1.5	9.4 ± 0.5	13.7 ± 0.3
Calorific value (MJ/kg)	17.4 ± 0.0	18.8 ± 0.0	17.7 ± 0.1	19.7 ± 0.1
Avg. (%) ± Standard deviation, in dry weight basis				

Table 1: cell wall and cell content values of pulp, husk, mucilage and parchment

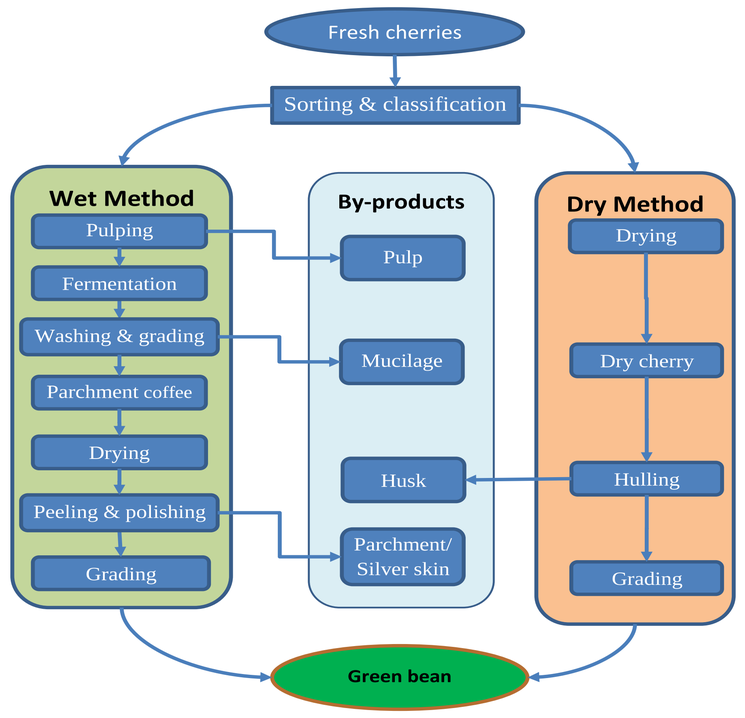

Fig. 2: Primary coffee processing pathways

- The parchment had highest cellulose (44.7%), hemicellulose (19.9%) and lignin (32.2%) content of the by-products fraction, while the pulp and husk exhibited 31.6% & 32.0% cellulose, 8.5% & 14.5% hemicellulose and 15.5% & 17.5% lignin respectively
- The high lignin and lower ash content in the parchment makes it attractive for different biomass pressing, and thermochemical conversions; however it is less suitable for anaerobic conversion
- The pulp, husk and the mucilage have promising properties for bio-chemical and thermo-chemical energy conversion technologies
- The calorific value of parchment , husk and pulp was 19.7MJ/kg, 18.8MJ/kg and 17.4MJ/kg respectively; which is comparable to most common fuel woods

Conclusion

- Coffee processing by-products have promising potential for renewable energy production like anaerobic conversion and briquette/pellets
- Environmental burden caused by coffee processing by-products could be alleviated by employing renewable energy conversion technologies on the ‘waste’

www.biomassweb.org

Contact: MSc. Bilhat Chala
E-mail: bilhate.chala@uni-hohenheim.de
Phone: +49 711 459-24759
Fax: +49 711 459-23298

SPONSORED BY THE
Federal Ministry of Education and Research
Federal Ministry for Economic Cooperation and Development