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Non-recyclable cellulosic waste briquettes consumption in Andean areas: assessment of social acceptance and potential applications

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Introduction: Research in waste-based briquettes production and consumption

Background: Pilot project and case study

Methods: questionnaire survey, laboratory analysis, qualitative and on-field tests

Results: Social involvement, fuels quality and potential applications

Concluding remarks: Are waste based briquettes sustainable?
Main issues to solve in Bolivia (Andean area)

- **Solid waste management**: find potential alternatives to final disposal
- **Resource circularity**: find alternative options to recover waste
- **Lack of energy sources**: non-renewable energy (methane) and no-biomass available in the Andes
Research conducted from 2019

- Waste briquetting can be employed when no other treatment and recycling options are available (among others)
- Waste-based briquettes are a better fuel compared to firewood (use of cardboard waste)
- Potential *environmental benefits* compared to fossil fuels.
- Waste-based briquettes are cheaper than wood but more expensive than Bolivian LPG and methane
Background

Development cooperative project financed by the Italian Agency for Development Cooperation

Non-recyclable Cellulosic waste-based briquettes production in Bolivia

Article

Circular Economy, International Cooperation, and Solid Waste Management: A Development Project in La Paz (Bolivia)

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Methods

Social survey:
Interviews (n=150) with structured questionnaires

Laboratory analysis of conventional and alternative fuels:
Thermal efficiency and emissions

On field analysis of briquettes combustion for heating and cooking
Results – Public acceptance

• Among fuels, they use methane, dung, and firewood.
• Around 39% use exclusively gas stoves, while about 12% use exclusively wood or dung.
• Globally, 61% of the citizens state that they use both wood stoves and gas stoves.

• Up to 70% of the respondents stated that the fuel employed is due to the easy access, while only 4% state that it is for economic reasons.
• About 81% of women buy fuel, in other cases they collect it along the way, as is the case of dung and shrubs. The costs of purchasing fuel are between 0.3 USD to 5 USD per month, which is equivalent to a methane jar.
Results – Laboratory analysis

Thermal efficiency

- Firepower [MW]

- Fuel type: Briquettes, Taquia, Shrubs, Dung

- Thermal efficiency [%]

Emissions analysis

- CO emission [g kg⁻¹]

- PM2.5 emission rate [mg kg⁻¹]

- Fuel type: Briquettes, Taquia, Shrubs, Dung

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Pilot analysis show that briquettes can be employed for **reducing about 30% of the conventional fuels** (animal dung and brushes), with a **potential increase of costs of about 3 to 5 times**: on balance, the potentiality exist, but waste-based briquettes seems to be too expensive compared to conventional fuels.
Concluding remarks

At household level, briquettes cannot be effectively employed for three main reasons:

- **Cookstoves are not appropriate for burning briquettes.** In the current situation, the higher thermal efficiency of briquettes are lost due to the lower performance of stoves.
- **Low-income families are not conveyed to buy an alternative fuel** to minimize pollution and maximize cooking efficiencies.
- **Middle-income households are more likely to buy methane** since they already have an improved cookstove for cooking.

For plaster production, briquettes allows to:

- Mitigate the weight of brushes and wood to be collected and burned during the combustion phase;
- Reduce the working time that the operators should spend during the night to feed the combustion chamber with brushed and Taquia;

The study suggested that the great potentiality arise to the local manufacturing, proposing that waste-based briquettes can be employed for pre-heating combustion chambers.

However:

- briquettes cannot be used to substitute 100% of conventional fuels (natural or fossil) and
- the costs seem to be too high if briquettes are not subsidised or briquettes’ production costs are covered by waste producers.
Thank you

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