Valorisation of Jatropha seeds cakes by solid state fermentation

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In order to solve the energy deficit issue, Burkina Faso like many countries in the developing world, is looking for alternative energy sources. Thus, the biofuel sector based mainly on Jatropha curcas is under development, with more than ten small and medium-sized businesses involved in the production of raw vegetable oil and biodiesel (MMCE, 2009). However, it allows the production of plant biomass residues, composed of cakes and hulls. Indeed, more than 85% of the Jatropha seeds biomass is not used to produce biofuel Amsallem and Trébout (2014) generating 500 to 800 kg of cakes per ton of seeds Devappa et al (2010). These cakes, despite their high protein content (55 to 64%) Belewu and Sam (2010), cannot be used as a dietary supplement for livestock because of the presence of antinutritional compounds such as trypsin inhibitors, curcinines, tannins, phytates and toxic compounds, such as phorbol esters Goel et al (2007).

The development of sustainable solutions to valorise these agro-industrial wastes to produce valuable products is necessary to solve the pollution issue and sustain the sector. One of the promising methods of biomass valorisation is the Solid State Fermentation (SSF) using fungi Roussos et al (1995), Perraud-Gaime et al (2011), Gutierrez-Sanchez et al (2013). Thus, in this study, four fungal strains (isolated from environmental and food samples) are used in SSF of Jatropha seeds cakes to compare the substrate effect on fungal spores production, test the enzyme production and quantify the protein enrichment of the biomass.

Two types of substrates (substrate 1 and substrate 2) at a moisture content of 66% were used. Substrate 1 was composed of Jatropha seeds cakes (80%) and sugarcane bagasse (20%) while substrate 2 consisted of 70% Jatropha seeds cakes, 20% sugarcane bagasse and 10% wheat bran. The experiments were conducted for one week by incubating 30g of each substrate at 25°C for the food strains (YM14 and BF) and 30°C for the environmental strains (JC3 and TG7).

The results obtained showed that the environmental strains have faster growth and more important spores production on PDA medium than the food strains (Figure 1).

![Figure 1. Fungal growth (a) and spores production (b) profiles on PDA medium.](image-url)

Fungal growths resulted in an increase in pH, whatever the substrate and the strain used. Substrate 2, consisting of 70% Jatropha seeds cakes, 20% sugarcane bagasse and 10% wheat bran was more convenient to the production of spores, regardless of the strain, compared to the substrate 1 (data not shown). The production of reducing sugars by the strains presented different profiles that seem to be related to the production of...
endocellulases. For example, using substrate 1, the production of reducing sugars started from the 44th hour to the 96th hour (Figure 2a). On the substrate 2, the production of reducing sugars started at the 20th hour and continued until the 116th hour (Figure 2b). This evolution could be explained by the production of endocellulases. Indeed, using substrate 1, the carboxymethyl cellulase activity (CMCase activity) started from the 24th hour, reached its maximum at the 64th hour and then, decreased to zero at the 116th hour (Figure 2a). When using substrate 2, the CMCase activity started at the 24th hour and occurred continuously until the 160th hour (Figure 2b). It is also noted that all strains are capable of enriching both types of substrates with proteins.

![Graphs showing reducing sugars and endo-cellulase activity](image)

**Figure 2.** Profiles of reducing sugars (RS) and carboxymethyl cellulase activity of TG7 strains grown on substrate 1 (a) and 2 (b)

This study showed that *Jatropha* seeds cakes can be used for fungal spores and enzymes production as well as increasing the protein content of the seeds cakes. It opens up prospects for valorizing *Jatropha* seeds cakes for the production of valuable products like enzymes and cattle feed.

**References**


