

# 12<sup>th</sup> World Congress on **Biofuels and Bioenergy**

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# 13<sup>th</sup> Global Summit and Expo on **Biomass and Bioenergy**

September 04-06, 2018 | Zurich, Switzerland

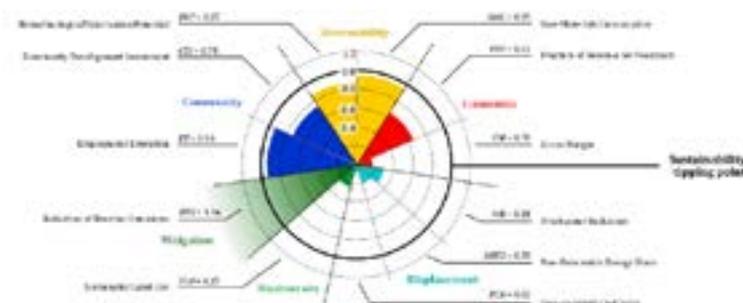
### **Ex-ante and ex-post sustainability evaluation of a biorefinery: Lessons learned from jatropha biodiesel in Yucatan, Mexico**

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The concept of sustainability is implicit in the definition of a biorefinery. Life cycle thinking as well as environmental, social, and economic assessments are intrinsic to a sustainability evaluation. There is an abundance of methods and indicators to perform sustainability evaluations; the more approaches are used, the better will be the understanding of the interlinkages between the issues in this multidimensional problem. In this work, we present two approaches to the sustainability evaluation of jatropha plantations for biofuels in Yucatan, Mexico. The *ex-ante* evaluation was performed during the early implementation of the project, from a biorefinery-process design perspective. The *ex-post* evaluation was performed after the fourth and final year of the project, heavily based on interviews and surveys with relevant stakeholders, and a life-cycle assessment. The *ex-ante* evaluation predicted potentially positive results from the biorefinery system, with all indicators in the social and economic categories within sustainable limits; the environmental performance of the system was sustainable only if the jatropha biomass was refined into a range of valuable co-products in addition to biodiesel. The *ex-post* evaluation was performed after four years of the project. At that time it was clear that the project had failed due to unrealistic, over-optimistic predictions of seed yields from the plantations that were established with very little knowledge of the crop. This inevitably resulted in the plantations being significantly downsized and the projects going back to the R&D stage. Interestingly, one of the companies obtained a sustainability certification from the Roundtable for Sustainable Biomaterials a few months before shutting down. The economic benefits to jatropha workers were significant and positive for both household income and local economies. If the issues with seed productivity and plant management had been well thought out from the beginning, the jatropha projects, they would have been of great value to the local communities.



**Figure 1.** Summary the sustainability evaluation. Indicators are normalized for attaining values between zero and one when in sustainable conditions.

#### Recent Publications

1. Navarro-Pineda FS, Ponce D, Sacramento-Rivero JC, Barahona Pérez LF (2017). An economic model for estimating the viability of biodiesel production from *Jatropha curcas* L. J Chem Technol Biotechnol 92(5):971-980.
2. Sacramento Rivero JC, Eastmond-Spencer A, Becerril García J, Navarro-Pineda F (2016). A three dimensional sustainability evaluation of jatropha plantations in Yucatan, Mexico. Sustainability 8:1316.
3. Sacramento-Rivero JC, Navarro-Pineda FS, Vilchiz-Bravo, LE (2016). Evaluating the sustainability of biorefineries at the conceptual design stage. Chem Eng Res Des 107:167-180.
4. Navarro-Pineda FS, Baz-Rodríguez SA, Handler R, Sacramento-Rivero JC (2016). Advances on the processing of *Jatropha curcas* towards a whole-crop biorefinery. Renewable Sustainable Energy Rev 54:247-269

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5. Sacramento-Rivero JC (2012). A methodology for evaluating the sustainability of biorefineries: framework and indicators. *Biofuels, Bioprod Bioref* 6(1):32-44.

**Biography**

Dr Julio Sacramento has a PhD on Chemical Engineering from the University of Manchester Institute of Science and Technology. His research interest is on how to apply sustainability thinking to process design in multidimensional systems. He has developed a couple of methods to assess the sustainability of biorefinery systems and is applying these to biorefinery concepts around the world. He is heavily involved in the promotion of biofuels in Mexico, serving in many academic and professional networks, such as the Mexican centre for innovation in biofuels (CEMIEBio).

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**Notes:**