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## **Production of Biodiesel in Bahia, Brasil - Planning concept of a plant with consideration of technological, ecological and socio-economic aspects**

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### Abstract

During the last 30 years, the sustainable supply with fuel has developed into a global strategic, and, in the last 15 years, also into an ecological topic. Although Brazil's crude oil production has shown a remarkable growth during the last 30 years, and the national energy-mix is marked by a comparatively high contribution of renewable energy (bio-ethanol and hydropower), the Government is planning to substitute 2% of fossil diesel by biodiesel by the year 2008, and 5% by the year 2013.

These governmental goals are driven implicitly by social motives and are promoted by state policies and tax reductions. According to these plans, a portion of at least 50% of the biodiesel demand has to be provided by the dry-resistant castor bean, cultivated by small farmers, the "Agricultura Familiar", in the semiarid regions of the Northeast of Brazil, in order to create new sources of income.

The preference of decentralized biodiesel production to industrial processes like hydrocracking, is being facilitated by the present state of technological development in this area. The objective of this thesis is the development of a concept for the implementation of a biodiesel plant in Bahia, Brazil, considering logistic, technological, socioeconomic and ecological aspects. The analysis of the regional agricultural production potential showed that, under small farming conditions, enough plant oil can be produced to meet the governmental plans which aim at substituting 2% of conventional diesel fuel until 2008 and 5% until 2013, with biodiesel.

The concept is based on the two first parts of the iterative project management method (definition of the project and project specification and project planning). The alternatives for possible production sites were ranged according to their advantages. The concept is based on the state of the art of biodiesel production technology in Brazil and in Germany and provides for certain modifications and adaptations to the specific local conditions. The ecological and social impacts as well as the economic viability are investigated using a simplified energetic balance and economical analysis, a qualitative evaluation according to the so called BMZ sociocultural key factors and a common calculation of costs.

The concept is designed for a middle-sized plant (4.000 kg/h) with continuous processing technology and modular construction. The transesterification process is conducted in the presence of a base catalyst using stoichiometrical quantities of alcohol. Different from most of the common processes used in biodiesel production, the washing step in the final treatment of the ester is omitted.

Because of the special technological properties of the castor oil, the glycerol separation can be enhanced successfully by adding common diesel fuel to the reaction mixture. The fuel produced with this technology meets the Brazilian and German norms for Biodiesel and is appropriate for the use as blend with high ester concentrations (B-50, B-30; B-20) or as an additive (B-2 und B-5) to common diesel fuel.

It was shown that, in mid term and under the proposed circumstances, biodiesel can be an alternative for the substitution of common diesel fuel in Bahia (Brazil). It has to be emphasized that economic viability and social benefits are closely related to the political and fiscal framework, and that the ecologic effectiveness is depending on the conditions of raw material production. As a guideline for future research, beside technological progress, optimal crop yields together with "low external inputs" have to be developed.