INSTITUTO DE PESQUISAS TECNOLÓGICAS

COMUNICAÇÃO TÉCNICA

**Nº 177276**

# Optimization of the steam consumption in soybean processing

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*Palestra apresentada no : OPTIMIZE 2021: THE FUTURE STARTS WITH INDUSTRIAL AL, 2021. (on-line)*



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OPTIMIZE 21 - The Future Starts with Industrial AI

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03/15/2021

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Overview | Background | Solution | Results


**Optimization of the steam consumption in soybean processing**

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Background: Soybean represents 58% of world's oilseeds production. Process with high steam consumption carbon footprint.

Solution: Representative model of an industrial soybean meal and oil production for process optimization by sensitivity analysis.

Results: Possibility of steam consumption and carbon footprint reduction by varying process parameters resulting in **9% of steam reduction and 2.9 $kgCO_2e/ton$ soy** of carbon footprint.

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Meal and oil are the main products from soy, the oil is an important component for the food industry. Soy meal is an essential source of protein in animal nutrition and protein concentrates and protein isolates for human consumption.

The industrial production of soybean meal and oil are characterized by its high steam consumption and high carbon footprint.

This work aimed to develop a representative model of an industrial soybean meal and oil production and use it to optimize the steam consumption, enabling the reduction of utilities costs and carbon footprint.

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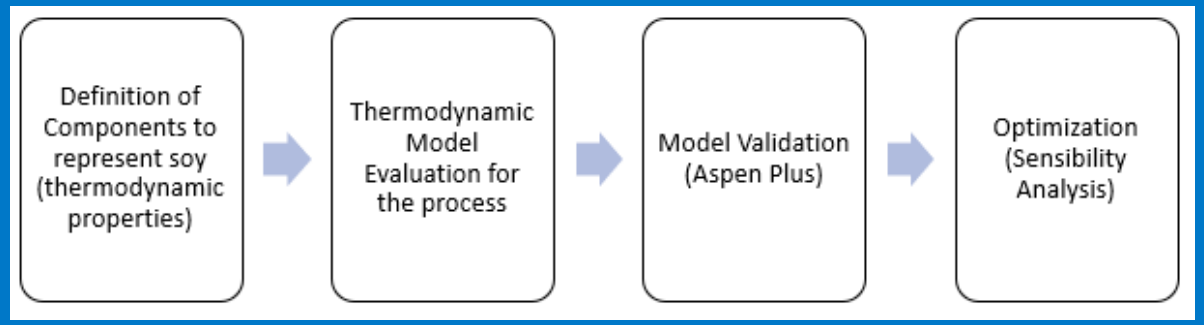
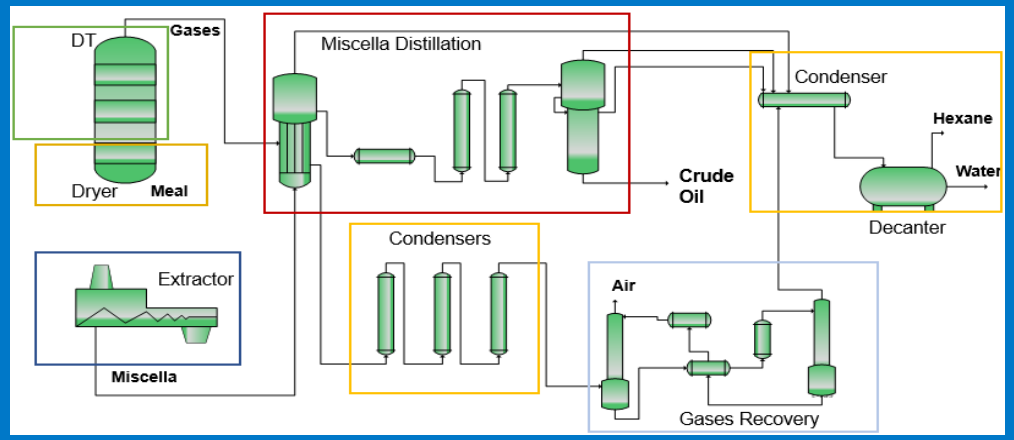
Firstly, it was accomplished an analysis to define the components to represent soy. The thermodynamic models was by comparing simulation results of a Desolventizer Toaster (DT) with real data of an industrial equipment. Then, the model of a typical industrial plant was built using Aspen Plus ® software and validated with process information available in literature. Finally, different parameters were studied to determine their influence on steam consumption.



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For a decrease of 7.3% in the direct steam added to the DT, the total steam consumption decreased 1.9% and the carbon footprint 0.5 $kgCO_2e$/ton soy. For a 10% decrease in the solvent retention in the cake, the total steam consumption decreased 7% and the carbon footprint 2 $kgCO_2e$/ton soy. For a 100mmHg reduction in the absolute pressure in the evaporators, there was a reduction in 2.7% of total steam consumption and the carbon footprint 0.4 $kgCO_2e$/ton soy. For a decrease of 0.3 $m^3$ of air inlet per ton of soy, there was a decrease from 0.2 to 0.3% of total steam in the whole process and the carbon footprint 0.07 $kgCO_2e$/ton soy.

| Equipment | Parameter | Parameter baseline | Reduction of the parameter | Total steam consumption reduction | Carbon Footprint reduction |
|---|---|---|---|---|---|
| DT | Direct steam | 101.17 kg/ton soy | 7.30% | 1.90% | 0.5 $kgCO_2e$/ton soy |
| | Solvent retention in the cake | 32% | 10% | 7% | 2 $kgCO_2e$/ton soy |
| Miscella Distillation | Pressure in evaporators and stripping column | 300 mmHg | 50 mmHg | 1.3 to 2.2% | 0.4 $kgCO_2e$/ton soy |
| Gases Recovery | Air inlet in the system | 1.5 m3 air/ton soy | 0.3 m3 air/ton soy | 0.2 to 0.3% | 0.07 $kgCO_2e$/ton soy |