UNIVERSIDAD DE LA FRONTERA

Facultad de Ingeniería y Ciencias

Doctorado en Ciencias de Recursos Naturales

New methods for cultivation of mixed microbial cultures towards polyhydroxyalkanoate (PHA) production in aerobic sequential batch reactors.

DOCTORAL THESIS IN FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE DOCTOR OF SCIENCES IN NATURAL RESOURCES

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“New methods for cultivation of mixed microbial cultures towards polyhydroxyalkanoate (PHA) production in aerobic sequential batch reactors”

Esta tesis fue realizada bajo la supervisión del director de tesis, Dr. David Jeison Nuñez del departamento de ingeniería química de la Universidad de la Frontera y ha sido aprobada por los miembros de la comisión examinadora.

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Thesis summary

"This thesis work focused on studying PHA (polyhydroxyalkanoates) generation and the necessary substrates for their production. Initially, volatile fatty acids were produced from solid residues of olive oil mills in acidification reactors. The results showed high accumulations of acetic acid in biomass under alkaline cultivation conditions (pH 9). In the second step, nine treatments were applied to select PHA-accumulating biomass using a response surface methodology. Two operational conditions were contrasted: the total cycle time of operation in sequential batch reactors and the substrate concentration (acetic acid). The findings indicated that longer cycles with higher acetate inputs resulted in greater substrate conversion into PHAs. In the third stage, new strategies for controlling the operation of sequential batch reactors under variable feeding conditions were evaluated and compared with the common feast and famine conditions. These new strategies promoted high PHA accumulation when the cycles were controlled and forced to self-regulate their feeding cycles. The highest production of polyhydroxybutyrate (PHB) was achieved when cycles were regulated at a ratio of 0.6 between feast and famine."