Vitamin B12 Bioprocess Design: Part I. Background & Upstream

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INTRODUCTION & OBJECTIVES

The vitamin B12 is the only vitamin that contains a organic complex molecule and an essential element cobalt. Humans are not able to generate such vitamin, while some vegetables can do it but this is inactive. Bacteria are mainly the organism that produces this biomolecule. Human beings must acquire this vitamin through the diet. These absence causes diseases like megaloblastic anemia. The aim of this work is the design of upstream and background for the production of vitamin B12 in an industrial plant.

BACKGROUND & UPSTREAM

The biocatalyst, Pseudomonas denitrificans, can be got through catalogs. Pseudomonas are gram negative bacteria with polarized flagella and aerobic metabolism. The production is intracellular and his number of ATCC is 13867.

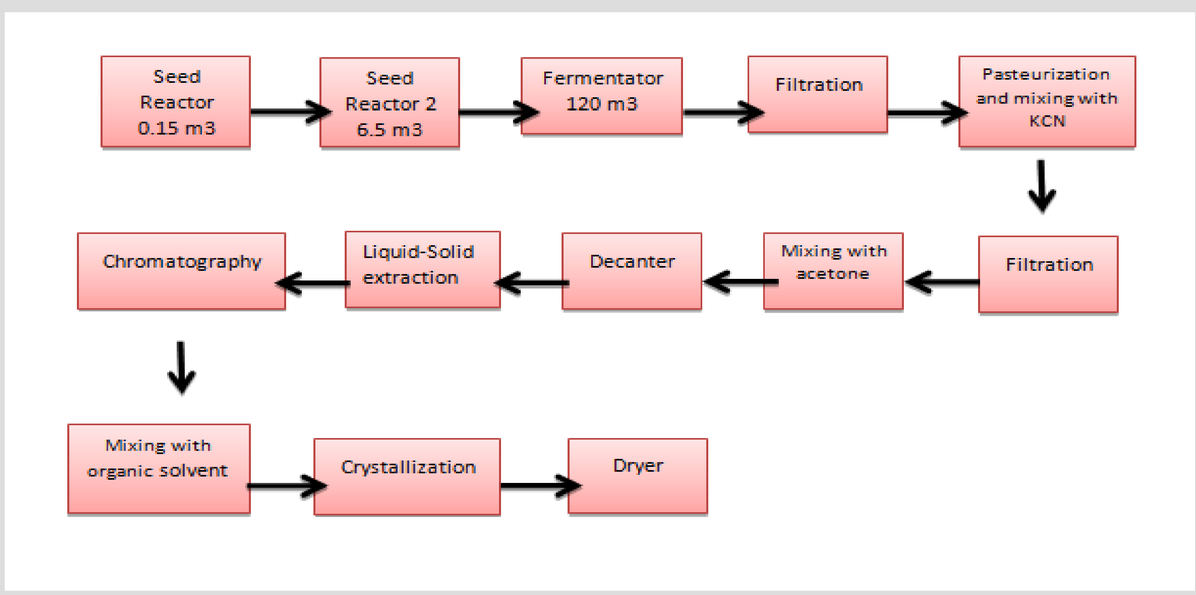
This plant is located in Brazil. It would be the first industrial plant of the continent and have easy access to the Argentine or American markets.
There are available a raw material very appreciated on this process.

The low concentration of biomass in the fermenter output makes it infeasible in continuous operation. There are not substrate inhibition, so it can be raised in batch mode operation. Only is recommend a fed-batch to maintain an optimal concentration betaine

Substrate	Sucrose		Molasses	
Source	Purchase	Own sugarcane	Purchase	From own production
Data	Readily available in Brasil.	Too much spending in land	Price of the molasses : 300-900$/ton.	Low-cost
Pre-treatment	Heat sterilization	Milling	Heat sterilization	Pre-treatment in the plant

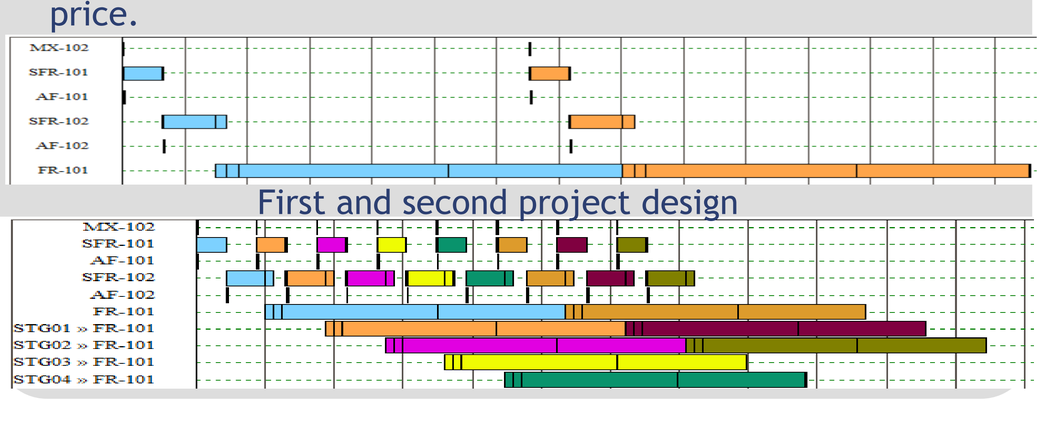
To prepare the inoculum, we choose a wild type strain and these is free to use. The first growing, is in culture dishes, then in roller bottles to reach the appropriate concentration in order to inoculate the first of the reactors that feed the main reactor

BLOCKS DIAGRAM



NUMBER OF FERMENTATORS

While we were doing the project, we realized that the production was scarce at first moment and counterproductive, then we saw that the dead time between operations was very high, and this is because the bottleneck of the process, the primary fermenter, was very limiting. To remove this limitation we designed a process with five fermenters where downtime decreased along with the unit price.



First and second project design

CONCLUSIONS

The conclusions of these project are that we have clear guidelines on how the project should be done in order to be a success. The use of five fermenters to eliminate downtime, optimizing the production process, through genetic engineering, and other changes such as replacing or improving the carbon source, and a fed-batch for a determined compound are some of these. Also recommended a preliminary investigation in order to find data that still not known

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