

PRODUCTION OF CYCLODEXTRIN (CD) USING IMMOBILIZED RECOMBINANT *Escherichia coli*

INVENTOR: DR ROHAIDA CHE MAN
FACULTY: COLLEGE OF ENGINEERING
UNIVERSITY: UNIVERSITI MALAYSIA PAHANG
EMAIL: rohaida@ump.edu.my
CO-INVENTORS: NURUL NABILA HUDA BAHARUDIN, NUR NADIA MOHD ZAKARIA, ZATUL IFFAH MOHD ARSHAD AND SITI ZUBAIDAH SULAIMAN



Product Background



CYCLODEXTRIN (CD)

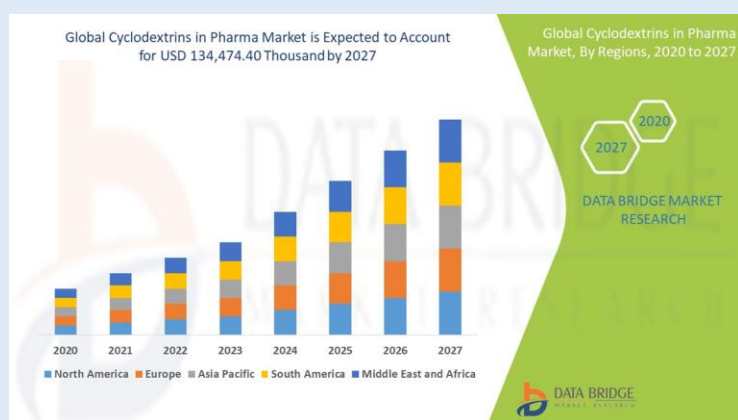
- Cyclodextrin glucanotransferase (CGTase) + starch → CD
- Nontoxic compound
 - capable to form molecular inclusion complexes
- Soluble in water

Application of CD

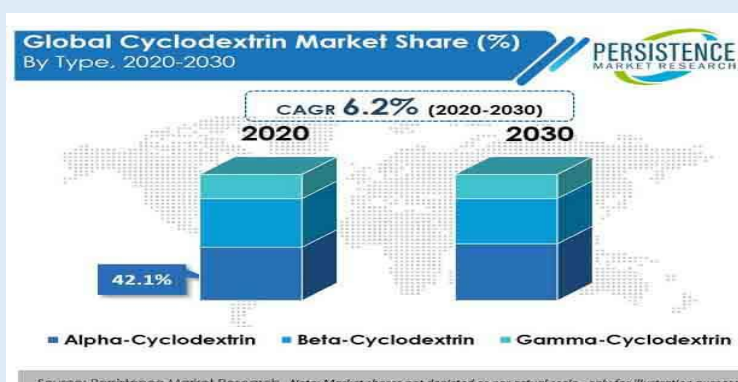


Marketability

CD market will record a 2.8 % CAGR in terms of sales over the next five years, with the global market size hitting US\$ 210 million by 2024, up from US\$ 180 million in 2019.



CD in Pharma Market by regions.



CD market share depends on their types.

Publication

- Immobilization of Cell for Cyclodextrin Production: A Review. Manuscript revision to Process Biochemistry (Q2, IF: 2.952)

Research Novelty

Used cell immobilization instead of enzyme immobilization and free cell.

- Enzyme is expensive.
- Free cell – Cause cell lysis.



- High production of desired product (CD and CGTase).

Used hollow fibre membrane as a support.



- Other supports are not stable and involving chemicals – Contaminate the product.
- Low cost and readily available.
- High porosity.

Reusability of the immobilized cell.

- Increase in productivity.

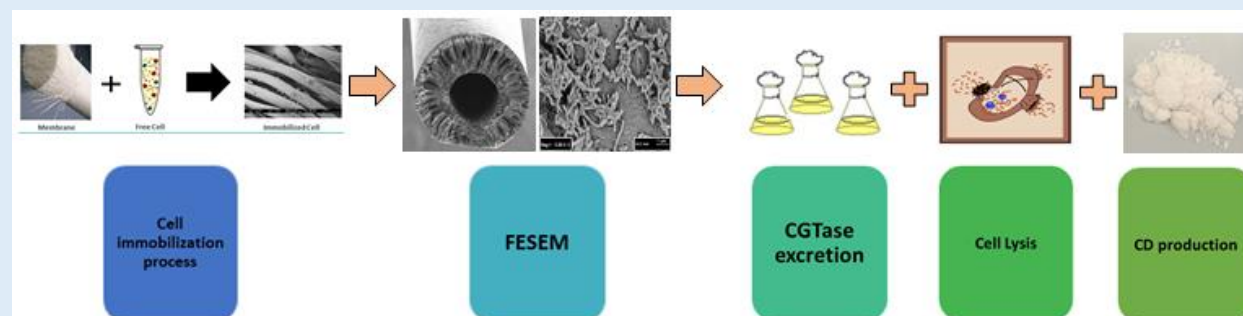
Economic Impacts

- Immobilized cell can be reused – reduce cost for separation process.
- Direct synthesis of CD in the medium (presence of substrate) without cell disruption – reduce operational cost.

Environmental Impact

Hollow fibre membrane offers green technology application to the environment because it does not require any chemicals for immobilization process.

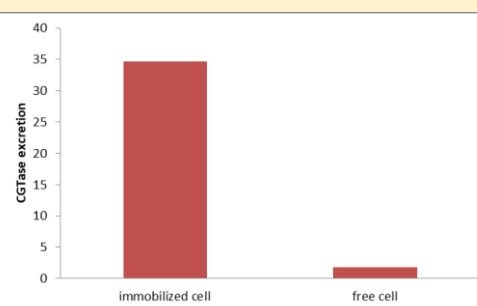
Methods



Results

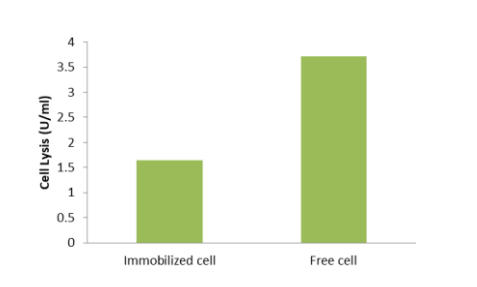
CGTASE EXCRETION

- About **20-fold** increment of the CGTase by immobilized cell compared to free cell.
- The high CGTase excretion can lead to high CD production.



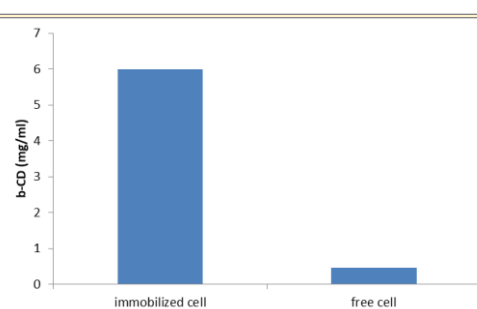
CELL LYSIS

- About **56% reduction** of the cell lysis when immobilized cell was used compared to free cell.
- Low cell lysis contribute in high CD production.



CD PRODUCTION

- The amount of CD from immobilized cell was **13-fold** higher compared to the free cell.



Achievement

- Fundamental Research Grant Scheme (FRGS), RDU1901113 from Ministry of Higher Education.
- Internal Research Grant (RDU190359) from Universiti Malaysia Pahang.
- Matching Grant UTM-UMP (RDU182305).