

THESIS PROJECT PORTFOLIO

**DESIGN OF A SUSTAINABLE MANUFACTURING PROCESS TO PRODUCE
PENICILLIN VK USING WASTE PAPER AS A GLUCOSE FEEDSTOCK**

(Technical Report)

**DISCRIMINATION IN DRUG DEVELOPMENT: COMBATING GENDER AND
RACIAL DISCRIMINATION IN CLINICAL TRIALS**

(STS Research Paper)

An Undergraduate Thesis

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SOCIOTECHNICAL SYNTHESIS

DESIGN OF A SUSTAINABLE MANUFACTURING PROCESS TO PRODUCE PENICILLIN VK USING WASTE PAPER AS A GLUCOSE FEEDSTOCK

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DISCRIMINATION IN DRUG DEVELOPMENT: COMBATING GENDER AND RACIAL DISCRIMINATION IN CLINAL TRIALS

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PROSPECTUS

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The scientific community is currently searching for effective ways to stimulate innovative drug research and development life cycle. The drug development process is uncertain and faces its own set of challenges, such as difficulty with target identification, and increased carbon emissions and manufacturing costs. To solve some of these challenges, the technical portion of the report discusses alternative solutions such as the use of wastepaper as a carbon source (glucose) for the microbial fermentation that is required for several drug development processes. Another solution for target identification includes diversifying clinical trials discussed in the social-technical report. Overall, the drug development cycle is complex, yet important. The goal of the whole process is for researchers to determine if a drug is safe and effective as a treatment for certain conditions. But it is vital that biotechnology and pharmaceutical companies come together to consider the causes and trends that bring on these various challenges to combat them and introduce beneficial drugs.

The technical project aims to produce an antibiotic drug called penicillin V. The facility was designed to produce 330 tonnes of penicillin V annually to meet the market demand in Sub-Saharan Africa. The facility will be built in South Africa. The novel aspect of the design is to use the conversion of wastepaper to glucose as a carbon source for the synthesis process. The use of wastepaper as a carbon source helps solve waste disposal challenges in South Africa. The production process is broken down into 3 main parts. The first step is the production of glucose from wastepaper, followed by an upstream process involving the fermentation of *Penicillium chrysogenum* to produce penicillin V. Lastly, a downstream process is designed to purify and convert penicillin V to penicillin V crystals. The final product is sold as an active pharmaceutical ingredient which will be used for the production of other penicillin derivatives. An economic

analysis was performed to determine that the project was economically favorable and that the design should proceed forward.

The STS report seeks to study how social groups in the U.S have sought to combat gender and racial discrimination in clinical trials to develop pharmaceuticals.

Clinical trials are essential for discovering new treatments for diseases, as well as new ways to detect, diagnose and reduce the chance of developing the disease. However, participants in clinical trials are mostly white males which neglect minorities. Due to this, the lack of diversity in drug development has become an essential issue because researchers can't gain the insights necessary to make the drug more effective for the right users. To answer this research question, an analysis of past literature, including statements, interviews, and research articles, is conducted. Based on the strategies analyzed, physicians, patient and community engagement, community partnerships, and collaborations can play crucial roles in overcoming barriers to clinical trials.

The projects were fruitful in terms of advancing my team management, individual working skills, as well as my research skills. From my perspective, organization and time management is key when working on a large complex project like this technical project, therefore starting early is helpful. Furthermore, I hope this project gives insight into other research questions and provide further advancement or suggestion in the field of research.