



Lindsay Kasuga
Chemistry, Environmental Science
Central Academy
Kemin Industries

Part I: Overview of Business

At Kemin Industries, an ingredient manufacturing company, the continual mission is to improve the quality of life for humans, their pets and animals. As part of this mission, Kemin strives to help solve problems such as providing food for a growing human population, fighting emerging diseases and preparing for other challenges. Kemin promotes the discovery and responsible manufacture of high quality ingredients, such as new food technologies to increase freshness of perishable food and pharmaceutical dyes with colorants that are naturally derived. Kemin is leading the way for a more healthy, responsible and sustainable future.

Part II: Job Specifics

The Speciality Crop Improvement (SCI) team is tasked with the discovery, extraction and testing of biologically significant molecules. From producing natural anti-microbial molecules for pet-food treatment to discovery natural emulsifiers for personal care products, the SCI team works diligently to meet the demands for naturally derived compounds in various household products. As an example, Kemin has developed propriety lines of rosemary, whose extract is useful for its powerful antioxidant abilities.

Part III: Introduce the Problem

The SCI team has discovered the one genus of plant produces a biologically important molecule of industrial interest. If this plant system could be used to generate enough quantity of this molecule of interest, the system could replace the synthetic route that is currently used to produce this molecule. The SCI team is challenged to address several aspects of this project:

- How to extract the molecule of interest from plant tissue
- How to confirm the identify of the molecule in the extracted material
- How to increase the amount of molecule produced by this species
- How to produce enough of the molecule to be commercially viable
- Cost-benefit analysis of plant production and extraction vs. synthetic production of molecule of interest.

Part IV: Background

In order to effectively address the problem, students would need a basic understanding of plant biology, molecular structure, and inter-molecular forces. Successful extraction of the molecule will depend upon an understanding of how intermolecular forces can be used to pull molecules of interest out of tissue. In addition, students will need knowledge of various separation techniques, such as distillation and laboratory procedures for determine the identity of a substance, such as chromatography. Students will also need an understanding of plant biology and breeding in order to propose solutions for increasing the amount of molecule present.

Part V: Business Solution

The SCI team addressed these issues by using steam distillation to extract the molecule of interest, and by experimenting with drying times to determine the optimum time for plant harvest and molecule extraction. Other members of the team worked to selectively breed individuals for increased molecular production. The SCI team has really used a multi-faceted approach, pulling on concepts from biology, chemistry and business, to address, and solve, this problem.

Part VI: Student Solutions

Students would propose the following solutions:

- Using different solvents for extraction of molecule of interest (polar vs. non-polar solvents)
- Different techniques to confirm identity (melting point, chromatography)
- Breeding experiments to increase molecule production