# An "Organic" Organic Project: The Design of a Sustainable, Cost-Efficient, Multistep Project Beginning with the Teaberry Plant Utilizing the Fundamental Techniques of Organic Chemistry to Synthesize Aspirin

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Environmental health and sustainability are major concerns for the twenty-first century. Therefore, this project was designed to create a sustainable, cost-efficient multi-step procedure that limits chemical waste while still learning fundamental organic chemistry techniques. The project began with the solid-liquid extraction of methyl salicylate from the teaberry plant using water. The teaberry plant is local to mountainous regions of North America. Next, steam distillation was used in order to separate methyl salicylate from the extract. The distillate contained water and methyl salicylate. Liquid-liquid extraction was performed to isolate the methyl salicylate. The identity of the methyl salicylate was confirmed by infrared spectroscopy (IR). Salicylic acid is synthesized during the next step by a hydrolysis reaction between methyl salicylate and sodium hydroxide, followed by the addition of sulfuric acid. The impure salicylic acid product was purified by recrystallization in ethanol and water and analyzed by IR spectroscopy and melting point. The salicylic acid was utilized for the final synthesis reaction, an esterification reaction with acetic anhydride to produce acetylsalicylic acid, commonly known as aspirin. The aspirin was recrystallized in ethanol and water and analyzed by melting point and IR spectroscopy. When utilized in an organic chemistry laboratory, the project would replace four to six weeks of experiments. The cost of the procedure was over a thousand dollars less than commonly used organic experiments. Additionally, the wastes include water and common household acids, bases, and salts. The isolated organic materials are needed for each subsequent experiment with the final product being aspirin.