Novel Sustainable Process for Synthesis of Acetylsalicylic Acid: Application to Opioid Epidemic and CO2 Emissions

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The opioid epidemic has reached alarming levels and was declared a national public health emergency. Use of street available opioids such as heroin have doubled and deaths from overdose have quadrupled since 2002, with an estimated 3.3 million users in the United States alone. One possible way to reduce heroin production is by minimizing access to acetic anhydride, a key ingredient that is illegally diverted from major users such as pharmaceuticals, particularly NSAIDs (Aspirin). Adopting principles of green chemistry, a novel process was developed to create an alternate way of synthesizing the active ingredient of Aspirin - acetylsalicylic acid – by replacing acetic anhydride with biobased reactants in the presence of biocatalysts. Optimization of this sustainable process resulted in yields, purity, and cost that were comparable to the current process followed in the industry but offered benefits of reduced CO2 emissions enabled by switching to biobased components. As an extension to the project, replicated controlled experiments using aqueous solutions of acetylsalicylic acid made by several of the new routes described above, resulted in about 50% longer radicles in mung seeds (Vigna radiata) and 16% higher reproduction efficiency in fruit flies (Drosophila melanogaster). Application of this work to farming in water-scarce regions, early stage immunity development of animals, CO2 emission reduction and potential reduction in opioid deaths are presented.

Awards Won:

Fourth Award of $500