A Novel Approach to the Synthesis of 3,5-disubstituted delta-2-isoxazoline as a Precursor to Various Diabetic Medications

Narayanan, Suhaas (School: Fort Collins High School)
Wang, Charles (School: Fossil Ridge High School)

The primary focus of this research is to identify and utilize a cost-effective pathway to synthesize 3,5-disubstituted delta-2-isoxazoline with consistently high percentage yields. 3,5-disubstituted delta-2-isoxazoline contains an isoxazole ring, which is an essential structure in novel Type I and Type II diabetes medications. The synthesis of 3,5 disubstituted delta-2-isoxazoline relies on a metal catalyst, also known as a metal-mediator, that converts an oxime into the desired product of 3,5-disubstituted delta-2-isoxazoline by forming the isoxazole ring structure. Palladium (II) chloride is the current metal mediator for the reaction and was tested against nickel (II) chloride and lead (II) acetate. It was hypothesized that all three metal-mediators will produce 3,5-disubstituted delta-2-isoxazoline. After the reactions were performed to synthesize 3,5-disubstituted delta-2-isoxazoline, lead (II) acetate was deemed the most viable and promising option for future research. In addition, nickel (II) chloride produced traces of 3,5-disubstituted delta-2-isoxazoline, meaning that it is another feasible option. The percentage yield in the lead (II) acetate mediated cyclization was calculated to be 21.4%, which was significantly greater than the 0-1% yield produced in the palladium (II) chloride mediated cyclization. The nickel (II) chloride mediated cyclization produced a calculated yield of 11.5%. In future research, both processes will be refined to optimize results. Lead (II) acetate and nickel (II) chloride are also substantially less expensive than palladium (II) chloride, increasing their feasibility for the pharmaceutical industry. These results also mean that both Type I and Type II diabetes treatment can be made more affordable for all people to access.