



Methyl Ketone Conversion to Carboxylic Acids Through the Haloform Reaction

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Methyl ketone conversion to carboxylic acids through the Haloform Reaction (HR) is a fascinating topic within the realm of organic synthesis. This field involves the manipulation of functional groups to create desired compound structures, and carbonyl-containing compounds, such as aldehydes and carboxylic acids, play a crucial role. These compounds can undergo various reactions, including oxidation and reduction. However, transforming internal carbonyls, specifically ketones, presents unique challenges due to the need to break carbon-carbon bonds. In this article, we will explore in detail the HR, a useful technique for converting methyl ketones into carboxylic acids.

The HR is a reliable and widely employed method for the conversion of methyl ketones to carboxylic acids. In order to perform this reaction, a methyl ketone with a methyl group positioned on one side of the carbonyl is required. The process begins by adding an excess of a strong base to the reaction mixture, which serves to deprotonate the alpha carbon adjacent to the carbonyl group. This deprotonation results in the formation of an enolate anion.

Once the enolate anion is generated, an excess of a diatomic halogen, such as chlorine, bromine, or iodine, is introduced as an electrophile. The enolate attacks the halogen, leading to halogenation of the molecule. This process is repeated two more times, taking advantage of the presence of two additional alpha protons. Consequently, a trihalomethyl anion is formed, which acts as a good leaving group due to its stabilization by nearby halogens.

After the halogenation step, additional base is introduced to the reaction mixture. This facilitates the attack of hydroxide ions on the carbonyl group, resulting in the regeneration of the carbonyl functionality and the release of the trihalomethyl anion. The trihalomethyl anion, being basic in nature, abstracts a proton from the newly formed carboxylic acid, leading to the formation of a carboxylate anion. Simultaneously, a Haloform molecule is generated, in which three hydrogen atoms are replaced by halogens.

To obtain the desired carboxylic acid, the carboxylate anion formed is protonated using an aqueous acid. This final step converts the anion into a carboxylic acid, completing the conversion process. It is important to note that the success and efficiency of the HR depend on the absence of alpha protons on the adjacent carbon. The presence of alpha protons can result in unwanted side reactions and decreased yields. Therefore, careful consideration of the substrate is crucial to ensure optimal results.

In conclusion, the HR offers a valuable and effective method for converting methyl ketones into carboxylic acids. By understanding the intricacies of the reaction mechanism and optimizing the reaction conditions, chemists can successfully achieve this transformation. The HR opens up new avenues in organic synthesis, allowing for the creation of diverse compound structures with significant applications in various fields. Continued research and exploration of this reaction will undoubtedly contribute to the advancement of synthetic chemistry and the development of novel compounds.