

Hypochlorite oxidation of endo- borneol to camphor essay



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The possible source of positively charged chlorine (Cl^+) was likely to be from heterolytic bond cleavage of chlorine: In the first step of reaction mechanism of hypochlorite oxidation of endo-borneol to camphor, a hydroxyl proton was replaced by the positive chlorine. In the second step, HCl was eliminated via E_2 elimination from the alkyl hypochlorite to form ketone. In the first step, Cl^+ was added to the alcohol but in the following step Cl^- was lost. The net change was a reduction of two electrons and the endo-borneol that provided the electrons was therefore oxidized.

To make sure there was an excess of hypochlorite oxidizing agent so that the reaction could go to complete, starch-iodide test paper was used at regular time intervals.

In acidic solution, iodide ions should be oxidized by the hypochlorite ions to iodine and therefore gave a purple black color. The result of this experiment was not very satisfactory, although the reaction was carefully controlled so that the temperature was kept more or less at 40°C . First of all, the yield of the product (24.5%) was quite low.

This was mainly because of the fact that there was significant loss of materials during transfer of crystals and because of incomplete conversion of endo-borneol to camphor. It was observed that during swirling of endo-borneol to help it dissolve in acetic acid, some of them got stuck on the wall of the flask, and therefore was not being oxidized by the hypochlorite.

but left a little bit of it to wash down the endo-borneol stuck at the wall. The loss of crystals during transfer could be minimized by more careful handling.

However, some loss seemed to be inevitable as it was impossible to get all the tiny crystals out from one flask to another. The melting point was much lower than expected. It turned out to be 136°C, instead of the theoretical value of nearly 180°C.

This great melting point depression proved that there were impurities present in our product. The impurities were likely to be the unreacted alcohol present in the product mixture, which was further confirmed by the analysis of infrared spectrum.

From our IR spectrum, a stretching absorption at around 3500 cm⁻¹ was observed and this corresponded to the hydroxyl stretching vibration (from 3200 cm⁻¹ - 3600 cm⁻¹). This proved the presence of OH functional group, that could only arise from alcohol, but not ketone.

Also, a peak at around 800 cm⁻¹ should be completely absent in a pure ketone product. The fact that it did not disappear also implied that there was unreacted alcohol. However, a large amount of desired product (camphor) was indeed present in the sample, as there was a strong peak at around 1750 cm⁻¹ (between 1600 cm⁻¹ - 1800 cm⁻¹), which proved the presence of carbonyl group.

To improve this experiment, the time of the oxidation reaction could be prolonged to ensure complete reaction and the sublimation experiment could be carried out in a larger scale and controlled in a more careful manner.

Answer to the questions 1) Stepwise reaction mechanism of hypochlorite oxidation of endo-borneol to camphor: 2) To determine the amount of endo-borneol present in a sample of camphor, one possible way to look for the <https://assignbuster.com/hypochlorite-oxidation-of-endo-borneol-to-camphor-essay/>

intensity of the peak at a specific absorption frequency that was characteristic of endo-borneol but absent in camphor.