

Adsorption of carbon from Liquid Hydrocarbons

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Abstract-Liquid hydrocarbons like on hexane (C₆H₁₄), octane (C₈H₁₈) heating with some colored salts like NiSO₄ produce black amorphous carbon on the surface of these salts turning them entirely black with the salt acting as catalyst by extracting carbon from the corresponding hydrocarbons. Colored cations like Ni²⁺, Cr³⁺ & their salts like NiSO₄ K₂Cr₂O₇, PbCrO₄ can extract carbon from liquid hydrocarbons.

Key words - NiSO₄; K₂Cr₂O₇; K₂CrO₄; PbCrO₄

1. INTRODUCTION

Colored salts like NiSO₄, K₂Cr₂O₇, K₂CrO₄, PbCrO₄ etc. can extract carbon from hydrocarbons like hexane, heptane, octane in which the salt acts as catalyst. It provides the surface on which carbon gets adsorbed. The salt does not undergo any change chemically which proves that it acts only as a catalyst and provides a surface for adsorption of carbon.

2.1 Experimental

When a colored salt like NiSO₄ is soaked in a hydrocarbon like hexane (C₆H₁₄), octane (C₈H₁₈) and heated, it turns black due to the deposition of carbon on its surface. On excess heating it turns in to an ash colored substance which shows carbon is charred. In case of PbCrO₄ the carbon particles smolder on the surface of the salt. K₂Cr₂O₇ & K₂CrO₄ turn black. Pb(NO₃)₂ first turns yellow due to decomposition of the salt into PbO and then turn black. Colorless salts e.g. NaCl, KCl (though they appear white) can not extract the whole carbon so they turn partially black and sometimes do not turn black at all. So they must not be used as the effect can not be noticed. However yellow NaCl which can be produced by heating NaCl in an atmosphere of Na vapor can definitely extract carbon from hydrocarbons and thereby turn black.

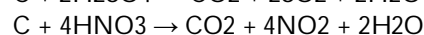
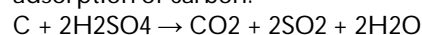
2.2. Experimental Observations

- NiSO₄ & hexane mixture when heated in a sealed tube turns ash.
- PbCrO₄ & heptane mixture smoulders on heating.

2.3 Proof that salts only act as catalysts

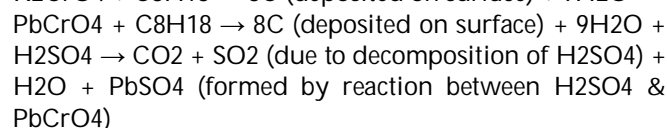
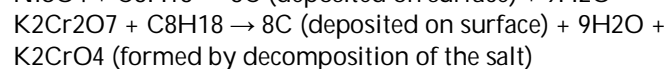
On heating the black substance with conc.H₂SO₄ or HNO₃, CO₂ is liberated along with formation of the corresponding sulfate or nitrate salts. SO₂ is liberated in

case of H₂SO₄ and NO₂ in case of HNO₃. This proves that the salts merely act as catalysts providing a surface for adsorption of carbon.



3. Results

Colored salts e.g. NiSO₄, K₂Cr₂O₇, K₂CrO₄, PbCrO₄ etc. can act as catalysts and extract carbon from liquid hydrocarbons when heated.



These reactions prove the formation of carbon and catalytic action of the salts.

4. Discussions

Liquid hydrocarbons can be converted to carbon by heating them with colored salts. Large amounts of carbon can be obtained by heating the hydrocarbon-salt mixture in a closed vessel. Hexane, heptane, octane, dodecane etc. when heated with Ni²⁺, Pb²⁺, Cr³⁺ etc. get converted into amorphous carbon.

N.B. Simply heating hydrocarbons without salts lead to mere evaporation and no carbon is formed.

5. Usefulness of the method

It can be used to extract carbon from liquid hydrocarbons. The black substance can be dissolved in water. The salt will become soluble and the carbon particles may be filtered out. Also it can distinguish between liquid

hydrocarbons and substances like CH_3COCH_3 which do not deposit carbon on the salts. When heated in a closed chamber the hydrocarbon salt mixture can yield large

amounts of carbon. It is also a new method of producing carbon from hydrocarbons besides incomplete combustion.

6. Table showing colors

Salt	Color	Color after heating with hydrocarbon
NiSO_4	Green	Black
$\text{K}_2\text{Cr}_2\text{O}_7$	Orange	Black
PbCrO_4	Yellow	Black
K_2CrO_4	Yellow	Black

7. Conclusion

Colored salts of transition metals which undergo d-d transitions can extract carbon from liquid hydrocarbons like hexane, heptane etc. in amorphous form.

Diagram

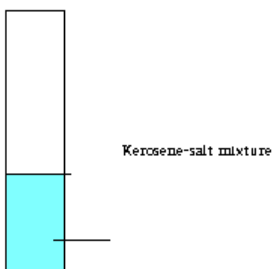


Figure 1 Kerosene-salt mixture

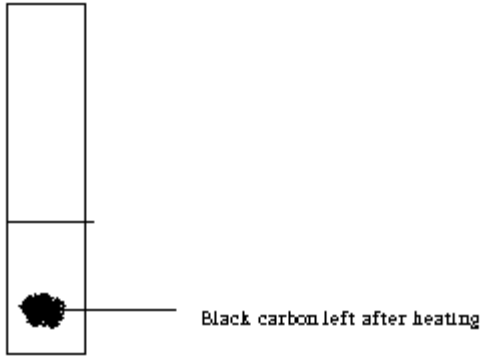


Figure 2 Black carbon adsorbed on the salt