THERMAL REGENERATION OF SPENT ACTIVATED CARBON SATURATED DURING TREATMENT OF ALOE VERA GEL

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ABSTRACT

Thermal regeneration of field-spent granular-activated carbons (GAC) is being increasingly adopted as a cost-effective alternative to disposal. The success of this practice requires the adjustment of process conditions to maximize recovery of original carbon characteristics while minimizing carbon loss. This article describes an investigation into the regeneration of Aloe Vera Gel spent GAC to make the process cost effective and to solve disposal problem. The carbon is initially investigated for its ash content, moisture contents and volatile matter. Regeneration is conducted in the presence of steam at different regeneration temperatures from 700°C to 900°C over reaction times between 30 and 90 min in order to achieve optimum condition for maximum surface area of activated carbon. Weight losses are determined for each condition and the resulting carbons characterized for their surface area in terms of iodine number and aqueous adsorption characteristics. Results shows that spent carbons recovered most of their adsorption characteristics when heated to 900°C for 30 min.

Research Equipment Assembly

Raw Materials & Product Samples

INTRODUCTION

Various forms of activated carbon are widely employed for the removal of organic pollutants from water and for the treatment of industrial effluents. Depending on their respective adsorption capacity, a natural saturating period is observed.

The economics of this practice is dependent on quantity of regenerated carbon and mass losses incurred during the process. Thermal regeneration involves two steps pyrolytic and an oxidative. In pyrolytic stage occurs spent carbon is exposed to temperatures up to 800°C. This results in elimination of volatile compounds. A residue of carbonized char is formed from the adsorbed compounds which occupies some of the carbon porosity. The oxidative stage involves controlled gasification of the pyrolysed carbon at temperatures usually around 800 °C. This results in elimination of charred residue and exposure of original carbon-pore structure.

The aim of this study is to regenerate spent carbon obtained from Aloe Vera Gel production process. This work investigates the effect of thermal pre-treatment on the subsequent gasification of spent GAC at different temperatures and times.

Methodology

- **Spent Granular Activated Carbon (GAC)**

The spent granular activated carbon was provided by the Pathology department, University of the Punjab Lahore. The spent GAC received was wet and was dried at 110oC for 24h to reduce the moisture content to less than 1%.

- **Thermal Regeneration of Spent Carbon**

Regeneration of the spent GAC was conducted in vertical tube furnace reactor consisted of a vertical 1.9 cm diameter stainless steel tube of 45 cm length. The furnace has 2.54 cm diameter quartz tube of 60 cm length externally heated by electric coil around the tube. Nitrogen [illegible] rat[illegible] measured by Rota meter while steam was generated in [illegible] scale boiler operated at controlled pressure.

The carbon samples were loaded into the reactor, heated at a constant rate 30 °C/min to final temperature of 800°C. When the target temperature was attained, steam was injected into the pre-heating furnace. Reaction times between 30 to 120 min were employed to produce different degrees of carbon burn-off. When the time was completed, the supply of steam was stopped, The furnace allowed to cool down under nitrogen atmosphere. After cooling the carbon samples were recovered and mass is accurately determined.

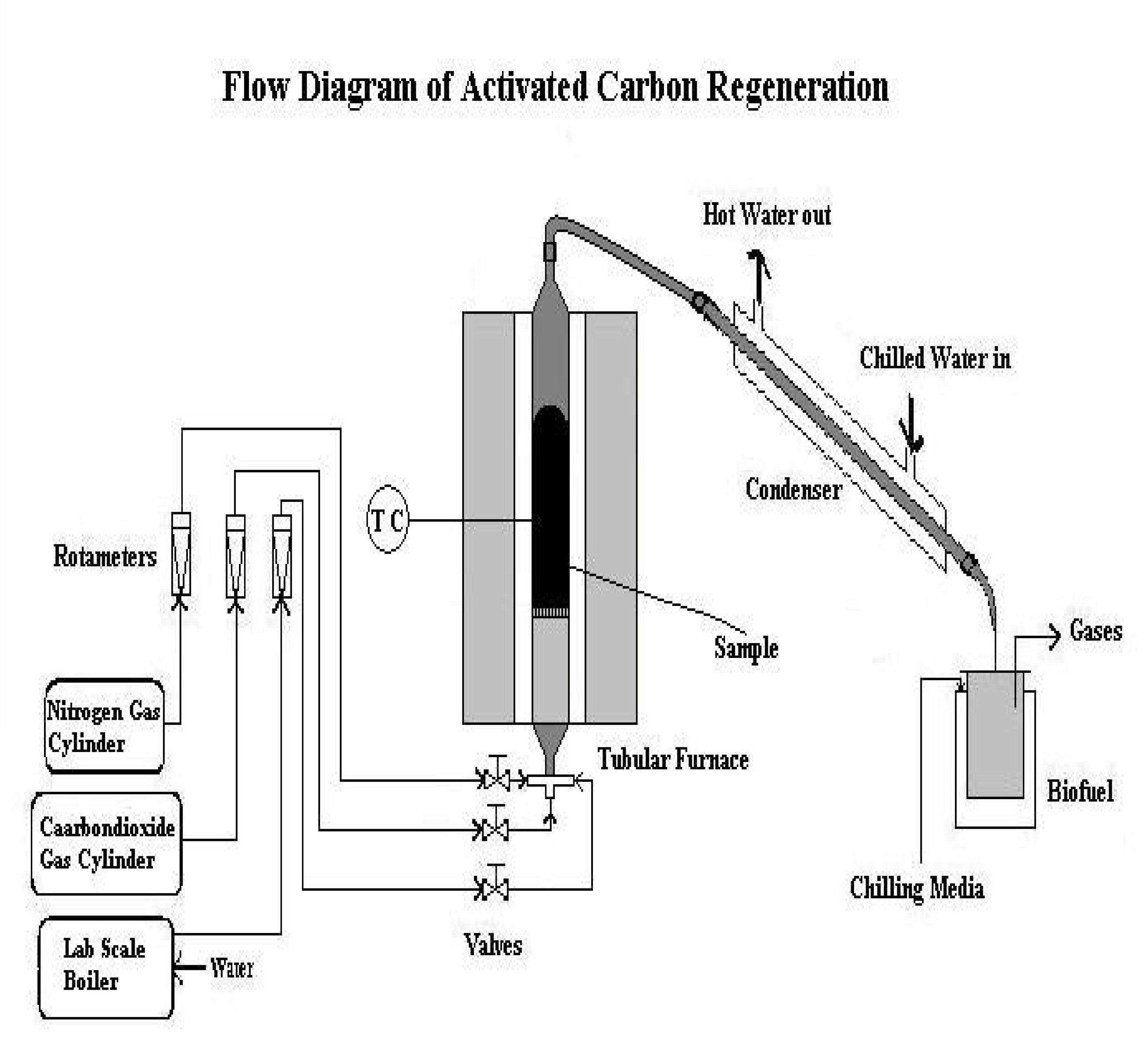
- **Characterization of Regenerated Activated Carbon**

The adsorption capacities of an activated carbon depend on the number of pores, their size and size distribution and are measured by adsorbing some standards adsorbents on the activated carbon.

The iodine number was determined according to ASTM D 4607-86 test method. The regenerated activated carbon was also used for the treatment of Aloe Vera Gel and compared the result with the freshly purchased activated carbon.

- **Adsorption Study**

For adsorption study, column was packed with activated carbon and Aloe Vera gel solution is passed through column. The amount adsorbed was calculated on the basis of initial and final color concentration in the Aloe Vera Gel solution.



RESULTS

Table 01: Proximate Analysis of Weeds Seeds (as received)

Analysis	%age
Moisture	28
Volatile Matter	12
Ash	2.5
Fixed Carbon	57.5

Figure 01: Effect of Temperature on Volatile Matter Loss

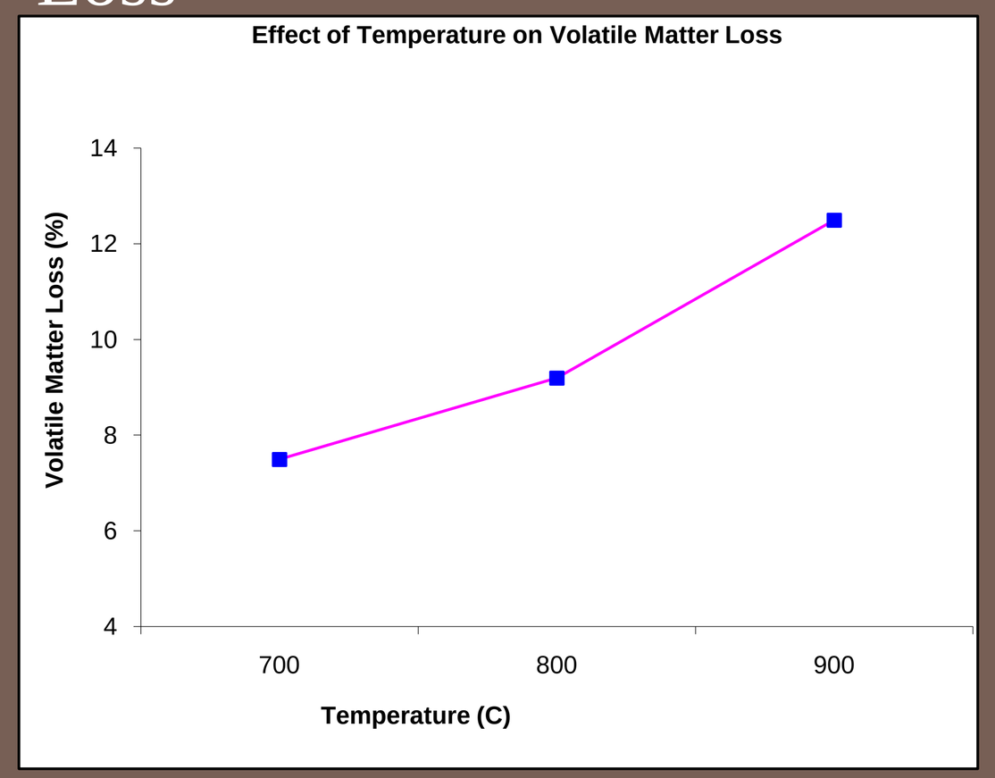


Figure 02: Effect of Temperature on Iodine Number

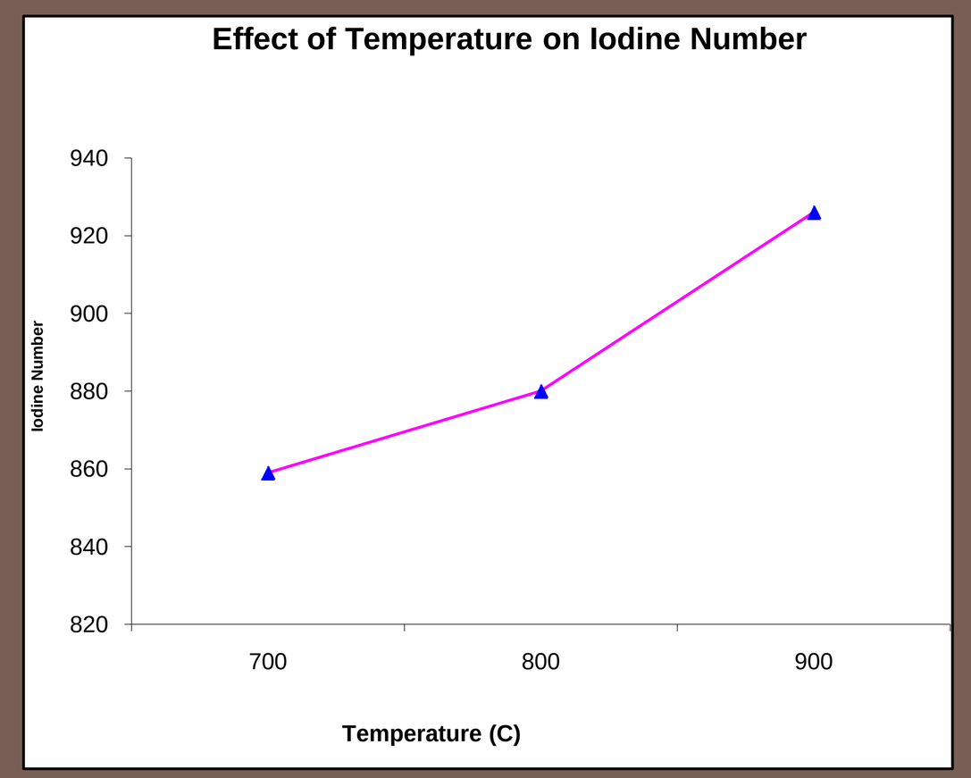


Figure 03: Effect of Time on Volatile Matter Loss

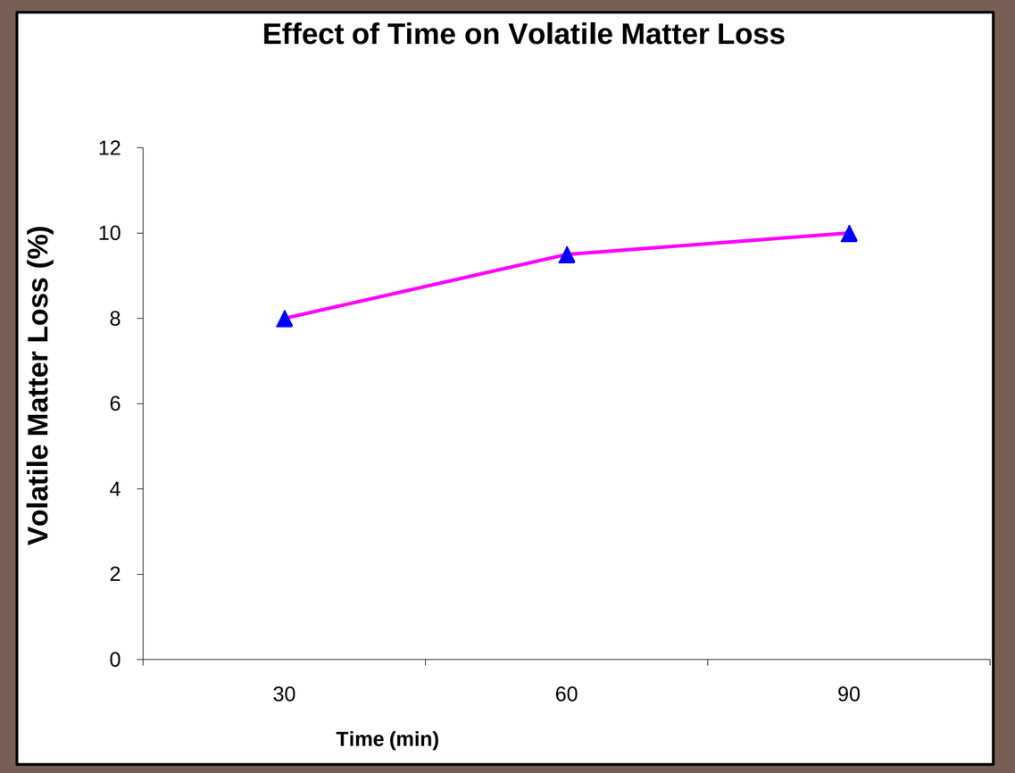
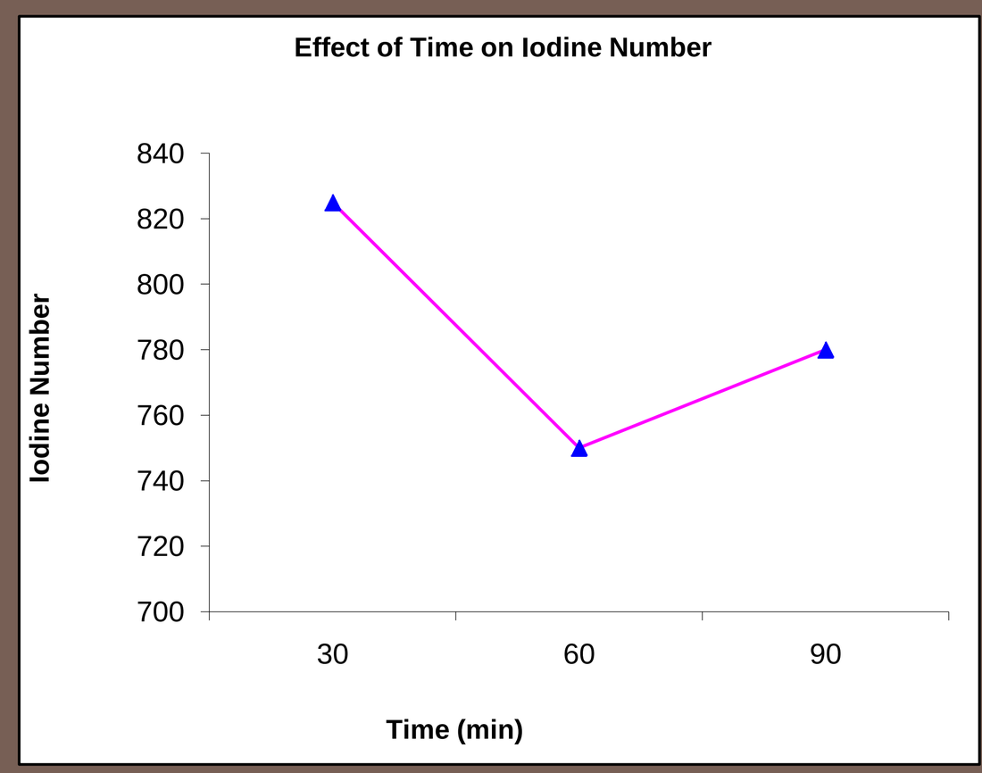


Figure 04: Effect of Time on Iodine Number



CONCLUSIONS

Most economical & high surface area activated carbon is produced from spent carbon through regeneration. This regenerated activated carbon has same result as original marketed activated carbon.

By regeneration, disposal problem of spent carbon is solved & production cost of aloe Vera gel is reduced. This project is launched on commercial level at Punjab University Lahore.

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