Ain Shams University
Faculty of Science
Chemistry Department

# Preparation, Characterization and Applications of Activated Carbon Adsorbents obtained from Different Agricultural Waste Materials

A Thesis
Submitted to Chemistry Department – Faculty of Science – Ain Shams University in Partial Fulfillment for Requirements of the Master Degree of Science (M.Sc) in Chemistry

By

**Ibrahim Mohamed Ahmed ElSherbiny**

B.Sc. in Applied Chemistry, Faculty of Science
Ain Shams University
2008

Under Supervision of

*Dr. Gamal Mohammad Saber Ali ElShafei*

Professor of Physical Chemistry, Faculty of Science,
Ain Shams University

*Dr. Christine Azer Philip*

Assistant Professor of Physical Chemistry, Faculty of Science,
Ain Shams University

*Dr. Atef Samir Darwish*

Lecturer of Physical Chemistry, Faculty of Science,
Ain Shams University

**2012**

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# Approval Sheet

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**This thesis for Master degree has been approved by:**

**Dr. Gamal Mohammad Saber Ali ElShafei**

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Ain Shams University

**Dr. Christine Azer Philip**

Assistant Professor of Physical Chemistry,
Faculty of Science, Ain Shams University

**Dr. Atef Samir Darwish**

Lecturer of Physical Chemistry, Faculty of Science,
Ain Shams University

Head of Chemistry Department

**Prof. Dr. Maged Shafik Antonius**

Ain Shams University
Faculty of Science
Chemistry Department

**Student Name:** Ibrahim Mohamed Ahmed ElSherbiny

**Scientific Degree: M.Sc.**

**Faculty Name: Faculty of Science – Ain Shams University**

**Graduation Year: 2008**

**Granting Year:**

**Head of Chemistry Department**
**Prof. Dr. Maged Shafik Antonius**

بِسْمِ اللّهِ الرَّحْمنِ الرَّحِيمِ

قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا
إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ
الْعَلِيمُ الْحَكِيمُ

صدق اللَّهُ العظيم

سورة البقرة – الآية (٣٢)

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## Abstract

**In the present study, new activated carbon (AC) materials were prepared from *Egyptian*-type agricultural waste materials; artichoke and *Vicia faba* peels, plus silkworm feces, via pure chemical activation method. In addition to the regular dehydrating agents (KOH, $ZnCl_2$, $H_3PO_4$), new activating agents were tested for the first time ever through the preparation method; including KCl, $CrCl_3$, and $TiCl_4$. The prepared AC materials were subjected to a complete characterization scheme in order to investigate the chemical structural, textural and morphological characteristics; using FT-IR, Boehm titrations, Point of zero charge, XRD, $N_2$ physisorption, Iodine number, and HR-SEM. Moreover, the results were compared and correlated with the previously proposed activation mechanisms. Then, AC materials were examined towards different applications; adsorption of methylene blue, lead, and cadmium from their aqueous solutions, hydrogen storage, and antimicrobial activity of silver supported ACs against *Staphylococcus aureus*, *Escherichia Coli* and *Pseudomonas aeruginosa*. Furthermore, the results of selected adsorption systems were correlated with different adsorption isotherm and kinetic models to study the mechanism of the adsorption process, and thermodynamic parameters were also computed.**



## Keywords:

**Activated carbon, Artichoke, *Vicia faba*, Silkworm feces, Adsorption, and Hydrogen storage**