

# ABSTRACT

**Student Name: Sohad Fouad Said El Sharnoby**

**Title of the thesis: Biochemical Studies on Production of Humic Substances and Their Application in Organic Farming**

**Degree: Doctor of Philosophy of Science (Organic Chemistry)**

Six different compost samples were evaluated. Marjoram compost was selected as the more humified one. Results of investigating isolation and purification procedures suggested milder methods to obtain good yield of humic acid with minimum structural alterations. Structural features studies of compost humic acid compared to more humified ones (i.e. Leonardite) and a synthetically prepared humic-like substance using a variety of wet-chemical and spectroscopic methods, exhibit noticeable similarity and revealed that they are close to soil humic acids with slightly less aromaticity, molecular weight and functional groups content. With respect to biological activities studies they inhibited *in vitro*, mycelial growth of 5 from 8 phytopathogenic fungi tested. also *in vivo* studies confirm the important role of humic acids isolated from marjoram compost as plant growth promoters and plant disease control agents in addition to their synergistic effect when dual inoculated with *Bacillus subtilis* or arbuscular mycorrhizal fungi and subsequently confirm their important role as natural, safe organic fertilizer which improve soil fertility and increase crop yield and quality.

**Keywords :** Humic substances, humic acids, fulvic acids ,compost, organic farming, organic agriculture, organic fertilizers biological control, biological activities, humification composting, humic-like substances.....

## Supervisors:

**1. Prof. Dr. Abdo Othman Abd Elhamied**

**Signature**

**2. Prof. Dr. Ahmed Mohamed Ahmed Ali Dokhan**

**Signature**

**Prof. Dr. Hamed Abd Ellatief**

Chairman of Chemistry Department  
Faculty of Science- Cairo University

## المستخلص

اسم الطالبة: سهاد فؤاد سعيد الشرنوبى

عنوان الرسالة: دراسات كيميائية حيوية على إنتاج المواد الهيموية وتطبيقاتها في الزراعة العضوية

الدرجة: دكتوراة الفلسفة (كيمياء عضوية).

تم تقييم ستة عينات مختلفة من الكومبوست وتم إختيار اكثرها تدبلا وهو كمبوست المردقوش. وقد أظهرت نتائج دراسة طرق فصل وتنقية الأحماض الدوبالية الحاجة الى الطرق اللطيفة للحصول على أعلى انتاجية مع أدنى تغيرات ممكنة فى التركيب. وبمقارنة الخصائص التركيبية للأحماض الدوبالية المستخلصة من كمبوست المردقوش بتلك المستخلصة من المواد الاكثر تدبلا مثل الليونارديت والمادة الشبيهة بالاحماض الدوباليه والمحضرة معمليا وذلك باستخدام خليط من التحاليل الكيميائية والطيفية فقد أظهرت النتائج تشابها ملحوظا مع اقتراب خصائصها التركيبية مع الخصائص التركيبية للأحماض الدوبالية المستخلصة من التربة ولكن درجة عطريتها ووزنها الجزيئى ومحتواها من المجاميع الفعالة أقل بدرجة طفيفة.

وفيما يتعلق بدراسه الأبتسطه البيولوجيه فقط أظهرت الأحماض الدوباليه المستخلصة من كمبوست المردقوش نشاطا تثبيطيا للنمو الميسليومى لخمسه من الفطريات الممرضه للنبات من بين ثمانية فطريات تم اختبارها معمليا. كما اكدت الدراسات فى الصوبه والحقل أهميه دور الاحماض الدوباليه كعوامل محفزه لنمو النبات وعوامل مقاومه حيوية بالإضافة الى تأثيرها التعاونى عند تلقيحها تلقيا مزدوجا مع بكتريا الباسيلس ستلس أو فطريات الميكورهيذا ومن ثم تأكيد أهميه دورها كسماد عضوى طبيعى مأمون يعمل على تحسين خصوبة التربة ويزيد من إنتاج المحصول ومستوى جودته .

السادة المشرفون

التوقيع

١. أ.د/ عبده عثمان عبد الحميد

التوقيع

٢. د/ أحمد محمد احمد على دخان

أ.د/ حامد عبد اللطيف

رئيس قسم الكيمياء

كلية العلوم - جامعة القاهرة

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## List of Abbreviation

E.C	Electrical Conductivity.
TOC	Total Organic Carbon.
CEC	Cation Exchange Capacity
HR	Humification rate.
DH	Degree of Humification.
HI	Humification Index.
TOM	Total Organic Matter.
TEC	Total Extracted carbon.
PDA	Potato Dextrose Agar.
TPF	2, 3, 5-Triphenyl Formzan.
IPM	Integrated Pest Management.
IFM	Integrated Fertilizer Management.
AMF	Arbuscular Mycorrhizal Fungi.
HAC	Humic Acid Carbon.
FAC	Fulvic Acid Carbon.
NHC	Not Humified Carbon.
HS	Humic Substances.
HA	Humic Acid.
FA	Fulvic Acid.
$E_4/E_6$	The ratio between the absorbance at 465 and 665 nm.
IHSS	The International Humic Substances Society.
FT-IR	Fourier – transform infrared spectroscopy
$^1\text{H-NMR}$	$^1\text{H}$ -Nuclear Magnetic Resonance spectroscopy
L E	Local Excitation Band.
BZ	Benzenoid Band.
ET	The Electron – Transfer Band.
$\epsilon_{280}$	Molar Absorptivity at 280 nm.
$\epsilon_{600}$	Molar Absorptivity at 600 nm.
PGPR	Plant Growth Promoting Rizobacteria.
$\lambda$	Wave length.