Ain shams University
Faculty of Women
for Arts, Science and Education
Chemistry Department

Study of the Influence of Microwave on the preparation of Sol-Gel

A Thesis Submitted for the degree of M. Sc.

In

Organic Chemistry

Presented

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QUALIFICATION

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DEDICATION

To

My distinguished parents
I do appreciate my god
For giving me such wonderfully parents
Who are enlighting and always supporting me
in all my life
I also thank my husband and my family
For continuous encouragement and help

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ABBREVIATIONS

Name	Abbreviation
Percentage of removal	% removal
3, 2-aminoethylaminopropyltrimetoxisilane	AEAPS
Aminopropyltriethoysilane	APTES
Amino-functionalized silica magnetite nanoparticles	A-S-MNPs
Brunauer–Emmett–Teller theory	BET
Differential scanning calorimetric analysis	DSC
Ethylenediamine	EDA
Fourier Transmission Infra-Red	FTIR
2-Hydroxyaniline	HA
Hexagonal mesoporous silica	HMS
iso-Propylamine	iso-Prop
2-Methoxyaniline	MA
Methylene Blue	MB
Sono-synthesized magnetite nanoparticles	MNPs
Metal alkoxides	MOR
Microwave	MW
Neodymium dihydroxy-nitrate	Nd
n-Propylamine	n-Prop
Plain	P
Pentaethylene hexamine	PEHA
Sorption capacity	q
Amino-functionalized nanoporous silica	SBA-3
Scanning electronic microscopy	SEM
Tetraethyl orthosilicate	TEOS
Thermal gravimetric analysis	TGA
Thiourea	THU
Tetramethoxysilane	TMOS
Urea	U
X-ray photometry spectroscopy	XPS
X-Ray diffraction	XRD

ABSTRACT

In materials science, the sol-gel process is a method by which monomers are converted into a colloidal solution known as sol, which acts as the precursor for an integrated network of polymers or discrete particles. Typically, metal alkoxides (MOR) are commonly used as precursor. Sol-gel technique comprises various steps starting with the preparation of a sol containing a precursor followed by aging and deposition of the sol on a suitable support, then evaporation of the solvent and volatile components, finally heat treatment results in pyrolysis of the remaining organics and densification of the sol-gel takes place.

Due to the pollutants such as heavy metals, dyes, emerging organic pollutants and others, which result in a bad quality of drinking water and aquatic ecosystems, leading to serious health and environmental problems, water purification or decontamination became of utmost importance. The conventional adsorbents used for water treatment still suffer from lack of efficiency, especially for some of the toxic and non-biodegradable pollutants. Therefore, there is a great need to find adsorbent materials that can improve the efficiency and meanwhile can be synthesized in a simple procedure.

However, in order to achieve sol-gel glasses to be efficient in water treatment, different factors were studied and the adsorbent efficiency have been measured and compared. The factors are:

1. Heating techniques

2. Presence of dopant.

3. Structural effect and nature of dopant.

4. Physical properties of sol-gel glasses.

Organic and inorganic-doped sol-gel glasses have been synthesized through three heating techniques which are: conventional thermal heating, conventional thermal heating followed by microwave irradiation, or microwave irradiation technique, using tetramethoxysilane (TMOS) in methanol as a precursor. However, in order to study the factors affecting the physical properties and adsorption efficiency of methylene blue (MB) from industrial water, sol-gel glasses have been prepared using different dopants: inorganic (neodymium dihydroxy-nitrate $Nd(OH)_2NO_3$, organic amines