

Development of Magneto-Separation Nanotechnology for Clearing Chemical and Radiological Contamination with Use of Sorbents

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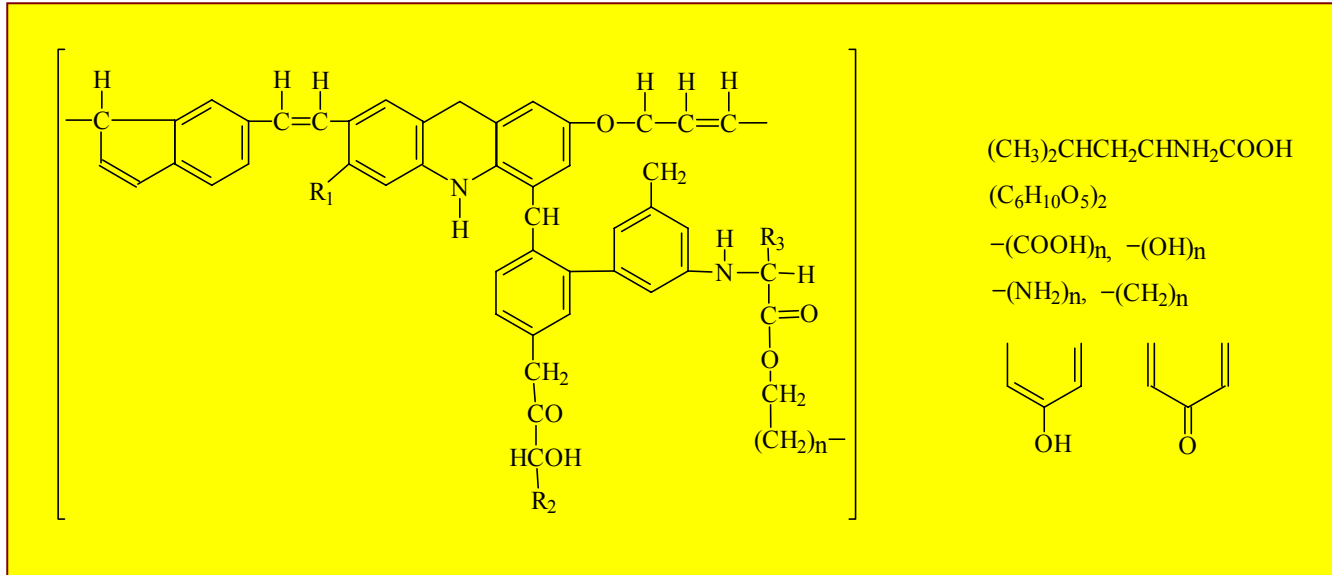
Chemical and Radiological Contamination of the Soil

**Magnetogravitational separation using a
metal nanoparticle-modified humic acid
sorber**

General steps of the process

- **Preparation of modified humic acids and their derivatives**
- **Synthesis of magnetoactive components of sorbent**
- **Complex formation and sorption of heavy metal ions and radionuclides**
- **Magnetogravitational separation**
- **Reactivation of sorbent**

Structure units of humic acids



• Modification of humic acids for obtaining function-enhanced sorbents

- sulfonation
- carbonylation
- construction of O,O-, N,O-, N,N- chelate units

Nanosized magnetite (ferrites) - magnetoactive components of the sorbents

•Chemical deposition

- Elmore reaction , salts of Fe (2+)/Fe(3+), NH₄OH, NaOH
- ferrites $\text{Fe}^{3+}/(\text{Fe}^{2+} + \text{Me}^{2+}) = 2:1$ или $\text{Fe}^{3+}/\text{Me}^{2+} = 2:1$

•Metallopolymeric synthesis

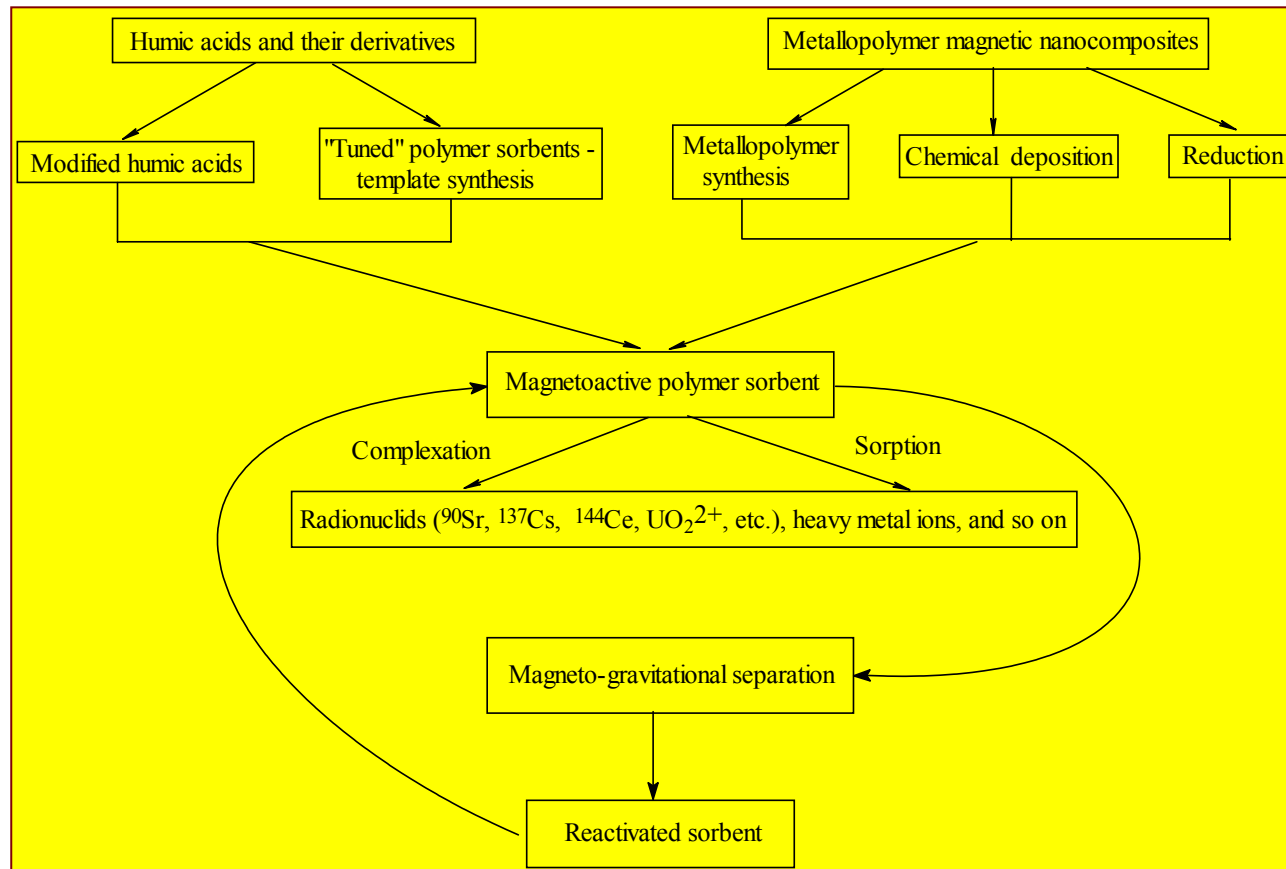
Organometallic precursors → metallopolymer
→ magnetic nanocomposite

How Magnetogravitational Separation of Conglomerate *Pollution Agent-Sorbent* Works

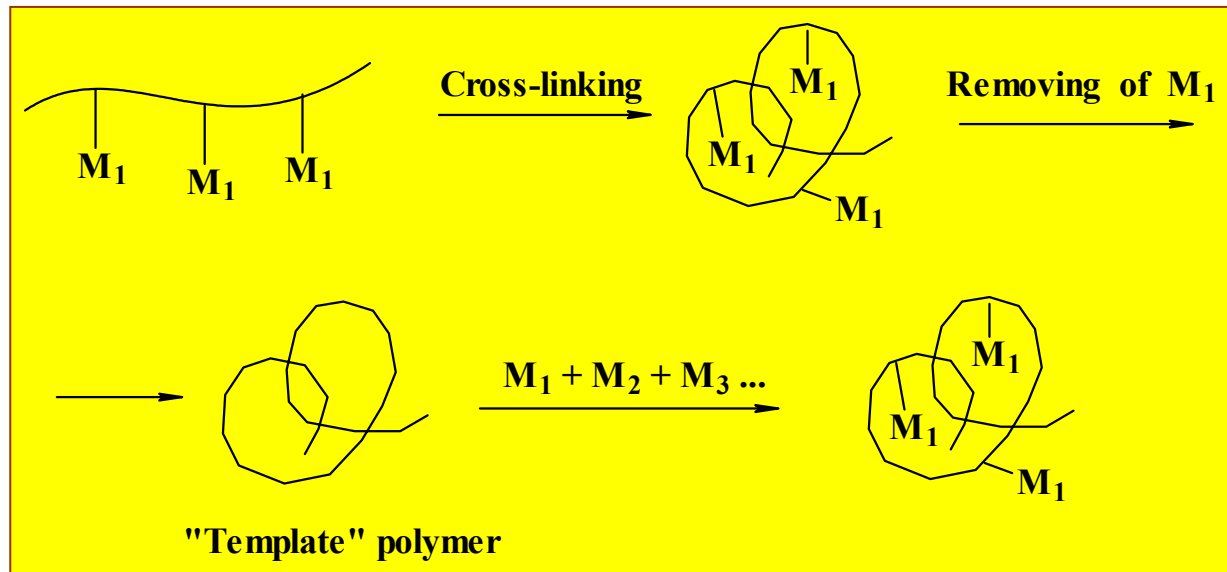
Magnetic energy

Gravitational energy

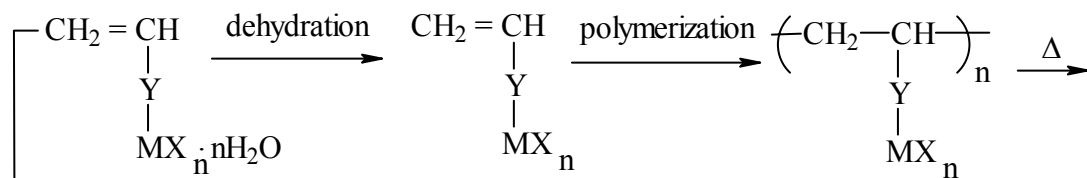
$$\gamma = E_{\text{magn}}/E_{\text{grav}}$$



Template synthesis (“template” arrangement of polymer sorbent) as a method for obtaining highly effective and selective sorbents

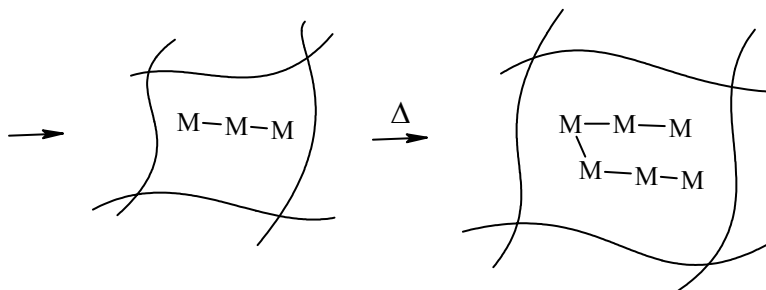


Metallopolymer synthesis as a way for obtaining magnetoactive sorbents



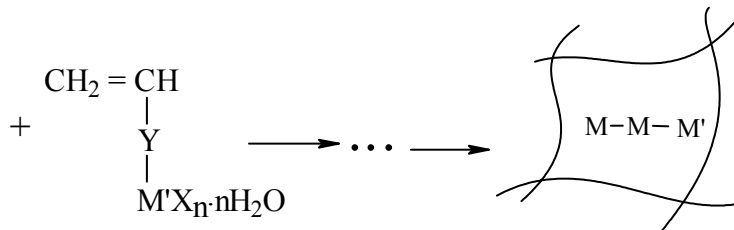
Core: 5-30 nm

Shell: 10-50 nm



The major stages:

- Dehydration
- Thermal polymerization
- Thermolysis

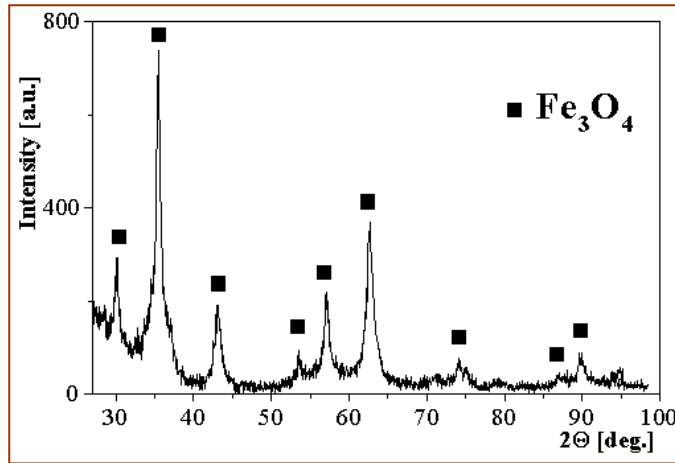


M = Co, Ni, Ba, Ln

M' = Fe

A.D. Pomogailo, G.I. Dzhardimalieva,
Rosenberg A.S., 1998, 2003

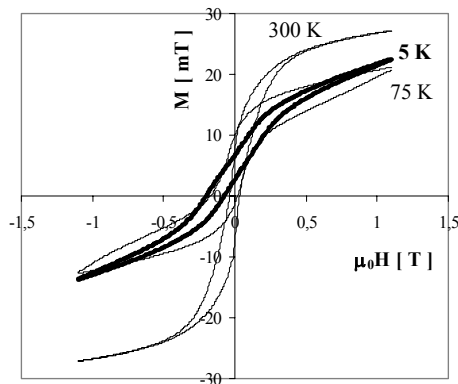
Magnetic properties of metalpolymeric nanocomposites



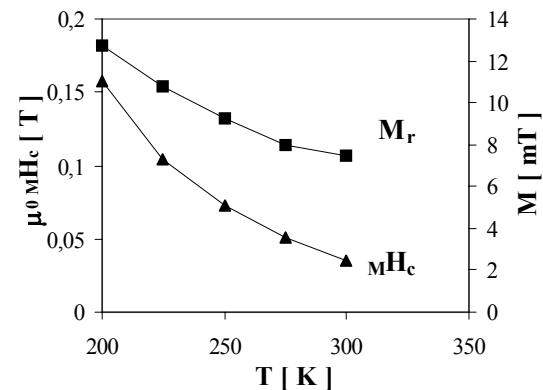
Ferromagnetic behaviour

Core-shell morphology

X-ray diffraction pattern for the product of iron acrylate decomposition



The hysteresis loops for the products of thermal decomposition (643 K) of Fe-Co acrylate complex measured at 5, 75, and 300 K (1.1 T)



The dependencies of H_c and M_r on the temperature for the product of thermolysis Fe-Co-acrylate at 643 K

About sorbent efficacy

- **High complex formation ability of humic acids and strong chemical binding**
- **Specificity and selectivity of humic acid sorbent action**
- **Humic acids as products of biogeocenose don't pollute the environment**

Applications of the proposed technology

- **Environmental remediation technology**
- **Novel enterosorbents for living organisms de-toxication**
- **Geotechnology**

We offer

- **An unique complex development in the field of the enviromental protection and rehabilitation of pollution areas**
- **Readily available and enviromentally safe natural sorbents on the base of humic compounds and their derivatives**
- **Simplicity of preparation methods and low prices of the starting materials**
- **High-skilled research teams of our institutes in the field of nanocomposite materials and chemistry and biotechnology of humic compounds**

Contacts

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