Environmental conservation by using Algerian clays in removal of phenolic pollutants from wastewater

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Abstract:

Phenolic compounds are considerate as persistent pollutants even at low concentrations by the Environmental Protection Agency (EPA). The limit values of phenolic compounds must not exceed 12 µg/l. Phenolic compounds exist widely in many industrial effluents such as petroleum refineries, coal tar, plastics, leather, pharmaceutical industry and steel. Phenols are considered among the most common organic pollutants in water because of their high toxicity, even at low concentrations. To tackle these problems, researchers have performed oxidation and adsorption onto clay as an effective and alternative process that can be used in wastewater treatment. The valorization of clay as a catalytic decontamination material is to promote the degradation of a specific organic pollutant, because it is very abundant and low cost. Our works focused on the application of Algerian clays for the adsorption and the oxidative degradation of cresols as one of the most phenolic pollutants.

Mots-Clés : Environment, Wastewater, Phenolic compounds, pollution, clays.

CLAYS in ALGERIA

LOCALISATION of Clays in Algeria

The raw clay used in our studies was taken at different points. (see figure) These deposits are exploited by the company "Bental" Algiers, a subsidiary of the National Company of non-ferrous mining products and useful substances (ENOF).

Deposit of Hammam Boughrara Maghnia, **TLEMCEN**

Deposit of Beni Adnan **SAIDA**


Deposit of M'Zila. **Mostaganem**

Phenolic Compounds and pollution

Phenolic compounds exist widely in many industrial effluents such as petroleum refineries, coal tar, plastics, leather, pharmaceutical industry and steel. They are in olive oil refinery, too.

Phenols are considered among the most common organic pollutants in water because of their high toxicity, even at low concentrations.
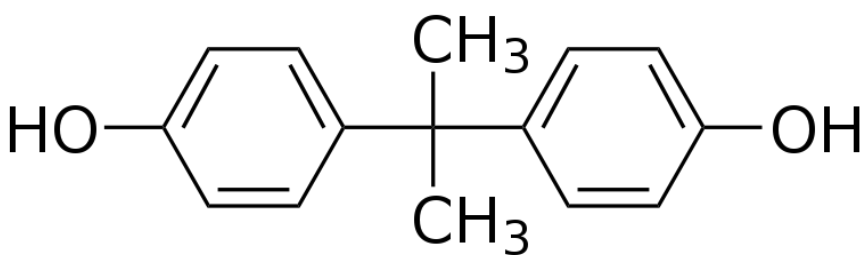
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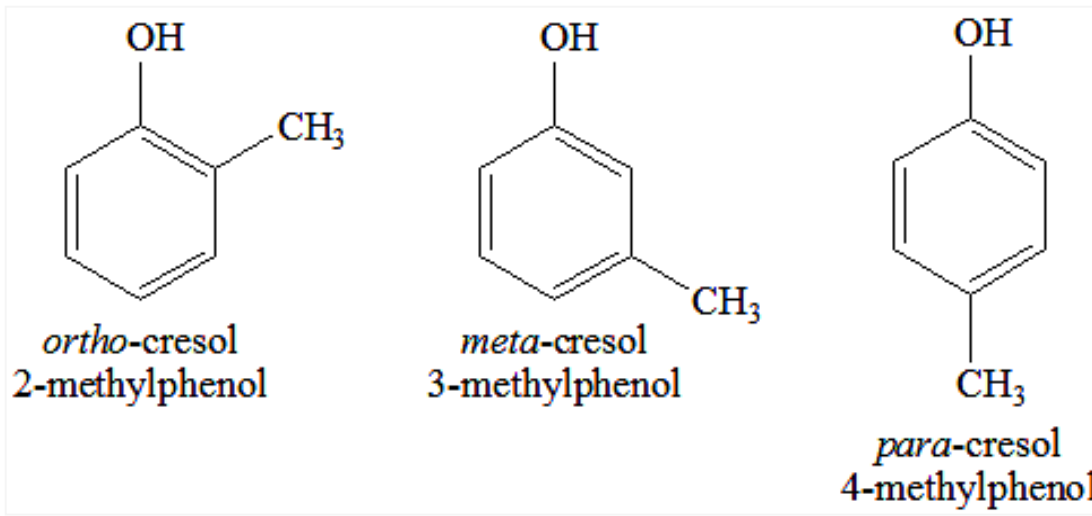

Removal of o-Cresol
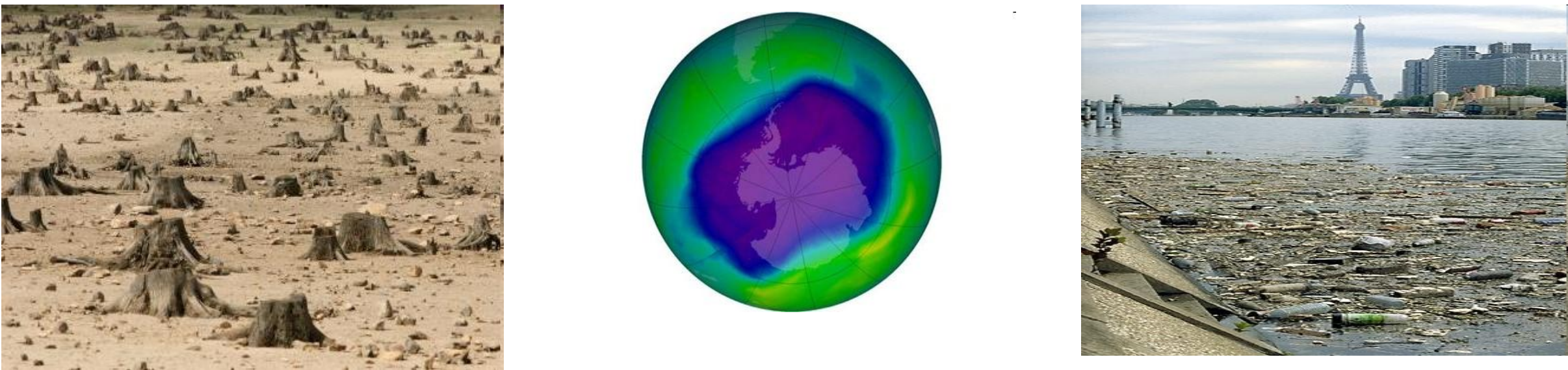
Phenolic Compounds and pollution
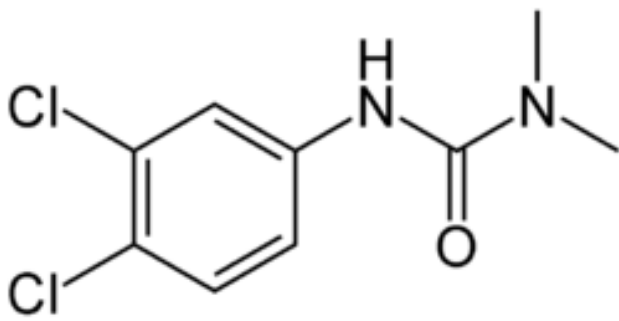
Diuron: phytosanitary product (pesticide) widely used in agriculture as a herbicide.

**Bisphenol A**: phenolic product, additive of food plastics; an endocrine disruptor..

ortho-cresol 2-methylphenol   _meta_-cresol 3-methylphenol   _para_-cresol 4-methylphenol

Cresols are produced or utilized in oil refineries, pharmaceutical industry, agribusiness, and household disinfectants (_William & Roper, 1992; Yi, Zhuang, Wu, Tay, & Tay, 2006_). Under the environmental protection laws, several countries have recognized cresols as very toxic phenolic micropollutants by either contact, inhalation, or ingestion, causing serious health and environmental problems (_Chena et al., 2016_).

Treatment methods of cresols
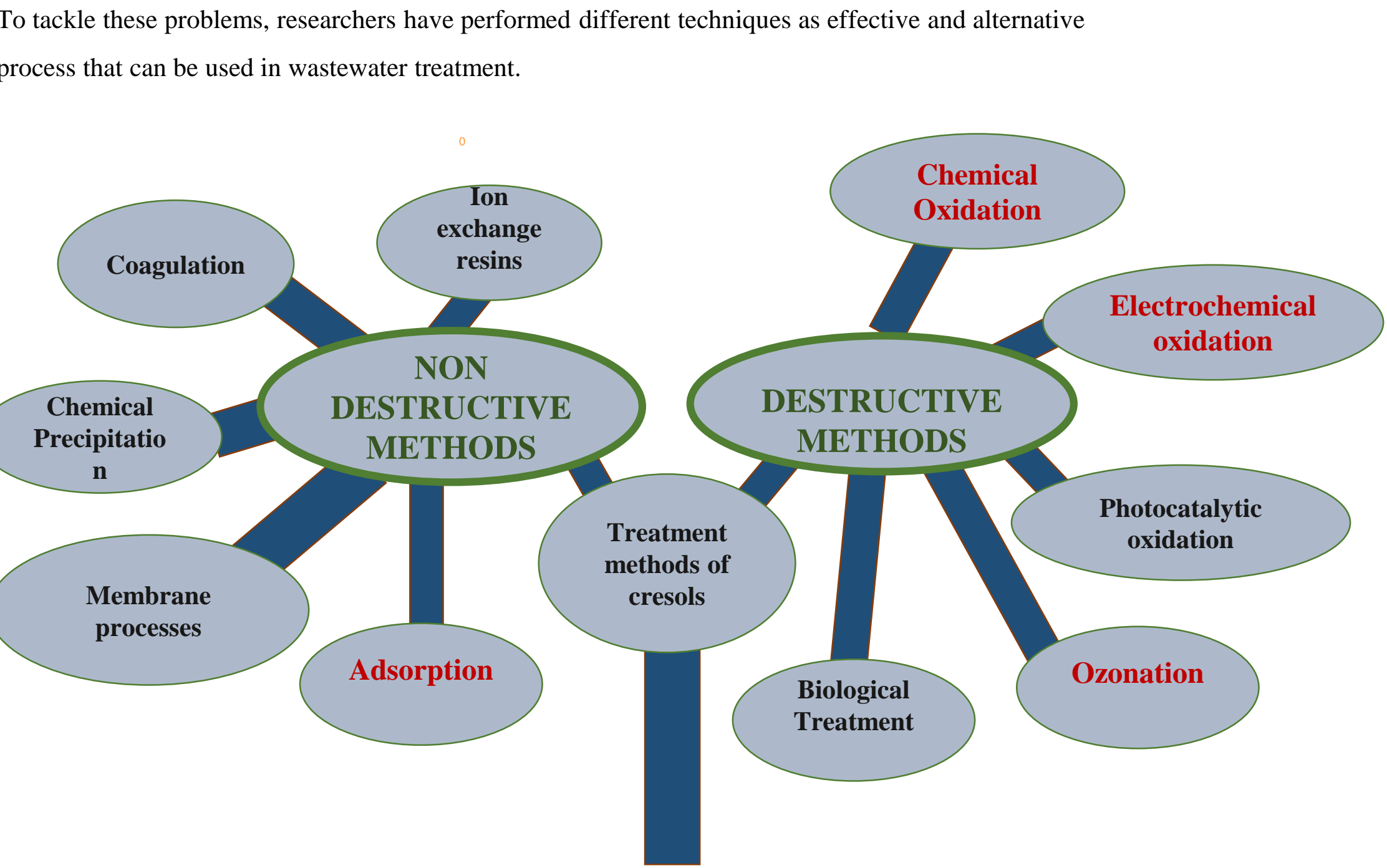
To tackle these problems, researchers have performed different techniques as effective and alternative process that can be used in wastewater treatment.

O-Cresol Treatments (Results)

Table . Results of degradation of o-cresol

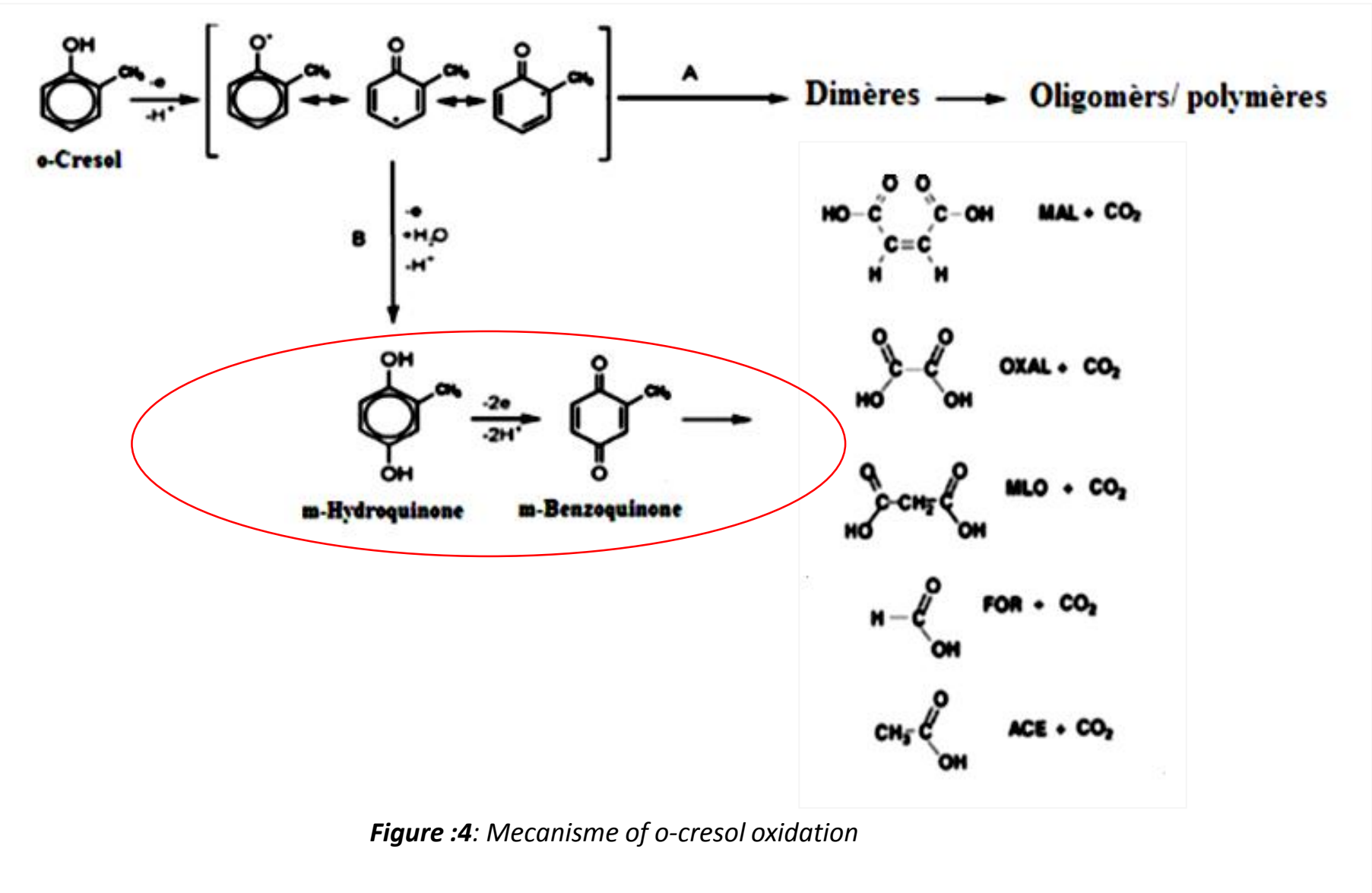|	Adsorption	Oxidation	Ozonation	Electrooxydation
With :	////	H_2O_2	Generator of O_3	Electrodes : Platinum or metal oxides
Clay	Adsorbant	Catalyst	Adsorbant	/////
Concentration (mg/l)	62.5	62.5	62.5	108.14 and 27
Temperature (°C)	25	55	25	25
Intermediaire	/////	2-methylbenzoquinone	2-methylbenzoquinone and 2-methylhydroquinone	2-methylbenzoquinone and 2-methylhydroquinone
pH	6.31	6.82	6.64	0.5 and 13
Time (min)	15	90	30	From 25 to 500
Conversion (%)	99.507	84.6	99.84	99.67 and 43.56

O-Cresol Treatments

Figure :4: Mecanisme of o-cresol oxidation

CONCLUSION

It is the valorization of the clay as catalytic material of depollution to favor the degradation of a precise organic pollutant, because it is very abundant and at low cost.

It shows a great potential for catalyst properties in the presence of the oxidizing reagent.

It proved to be an effective means for the degradation of O-cresol contained in wastewaters.

Finally, the objective of our laboratory LMC is therefore the depollution of water, a precious resource in our arid and semi-arid regions.