# Research Laboratory (10)

## Research Laboratory- 10

## Laboratory on Catalytic Reactions and Advanced Oxidation Processes

**Director:**

Prof. Dr. Gönül Gündüz

**Researchers:**

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**Description:**

**Subjects of researches:** In this laboratory, solid catalysts are prepared and the prepared catalysts are used in catalytic gas or liquid phase reactions. The investigated reactions mainly are; total oxidation reactions of organic compounds dissolved in water to $CO_2$ and $H_2O$, partial oxidation and isomerization reactions. In addition to these studies, the degradation of organic pollutants by individual and different combinations of Advanced Oxidation Processes (AOPs) such as, sonication, Fenton reaction and photo degradation are investigated. In catalytic reactions, the prepared catalysts are characterized, parametric and kinetic modeling studies of the reactions are carried out.

**Application areas:** Scope of the studies is to develop new and effective catalysts for oxidation reactions, particularly for the removal of organic pollutants (such as dyes, phenolic compounds) from water and to provide solutions to many environmental problems.

**Equipments present in laboratory:**

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GC (HP 6890)

HPLC ( Agilent 1200)

Ultra pure water equipment (Millipore Direct Q)

Ultrasonic cleaner (2) (C.E.I.A. CP 102)

Ultrasonic probe system (Bruel Kjaer)

Ultrasonic probe system (Bandelin HD3200)

Ultrasonic reactor (Meinhardt)

High temperature - pressure reactor (Parr 4576)

COD measurement (Lovibond Checkit Direct COD Vario)

$H_2O_2$ measurement (Lovibond)

Centrifuge (Nahita)

Mechanical stirrer (Heidolph)

Cooling Water circulator (Polyscience 9106)

pH meter (2) (Inolab level 1 ve Mettler Toledo)

Sensible balance (Sartorious)

Heater (3) (Electrothermal)

Drying oven (2) (Dedeoğlu ve Venticell)

Oven (Carbolite Furnaces)

Autoclave

Magnetic stirrer (IKA HS7)

**Experimental set-ups present in laboratory:**

Sonication reactor and ultrasonic probe system

Experimental set-ups for solid catalyzed liquid phase isomerization, catalytic wet air oxidation and wet peroxide oxidation

Fixed bed reactor for gas phase reactions (2)

Sonophoto oxidation system with UV-C lamps

Photo oxidation system with Visible light lamps

**Directed Researches and Projects:**

**Some of the studies carried out in this lab:**

Isomerization of α-pinene over ordered wide molecular sieves, zeolites (ZSM-5, Mordenite, Beta, Mesobeta, MCM-41), clays and heteropoly acidic catalysts, destruction of several organic pollutants by ultrasound, catalyst deactivation in n-pentane isomerization, Catalytic wet air oxidation of some carboxylic acids (butyric acid, maleic acid, acetic acid, formic acid and oxalic acid) at/or above atmospheric pressure over Pt, Ru and Pd catalysts prepared on $TiO_2$, silicagel, alumina and activated carbon, Decomposition of textile dyes (RR141, Rhodamine 6G, Orange II) and their degradation products by wet peroxide oxidation using iron and copper containing zeolite (ZSM-5) catalysts: In the presence and absence of ultrasound and SonophotoFenton oxidation of Rhodamine 6G over iron containing $TiO_2$ catalysts have been studied. In this concern, joint studies with Bulgarian Academy of Sciences (BAS), Abo Akademi University in Finland and National Academy of Science of Ukraine (NASU) were carried out, TÜBİTAK projects were realized.

The projects entitled “Degradation of Crystal Violet by Heterogeneous Fenton-like Oxidation over iron containing ZSM-5 Zeolite Catalyst and/or Sonication“, “Degradation of Acetic acid over Fe containing Zeolite Catalysts by Heterogeneous Fenton–like Oxidation in the absence and presence of Ultrasound“ and “Heterogeneous PhotoFenton Oxidation of Phenolic Compounds over iron containing $TiO_2$ Catalyst in the presence and absence of Ultrasound” and in the content of the PhD studies, the study of heterogeneous sonophotoFenton oxidation of Reactive Yellow 84 aqueous solution over iron containing $TiO_2$ catalyst are being carried out.

**Analysis:**

HPLC , GC, Uv-Vis Spectrophotometric analysis and COD measurements

**Directed projects:**

TUBİTAK projects(total): 8, Joint Reserach Project with BAS and NASU (International TUBITAK Projects): 2

BAP Projects: 15, EBİLTEM Projects: 2

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