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# The Effects of Inorganic Binder on Photocatalytic Oxidation (PCO) and Degradation of Acrylic Composites Containing Nano/Micro $TiO_2$

**Mohamed Rehim***

*Department of Analytical Chemistry, Stockholm University, Frescativägen, Sweden*

## Introduction

Today, air impurities caused by various sources have become one of the most serious issues in megacities. Paints and coatings have been identified as effective materials for addressing this issue. An air purifying paint can be applied to the large exterior and interior surfaces of buildings that are exposed to air pollutants. The preparation of a photocatalytic oxidative pseudo paint based on acrylic latex using Nano and micro $TiO_2$ particles was investigated in this study. As an inorganic binder, water glass was added to the acrylic latex at 5 and 10% wt. The effects of the water glass on particle dispersion, PCO rate, mechanical properties of the prepared films, and film degradation under UV irradiation [1].

Many problems arose as a result of countries' industrialization in the last century, including air pollution. This phenomenon occurs due to the high intensity of the pollutants and the environment's inability to adsorb and/or degrade them. Solids, liquids, or gases released into the atmosphere from natural sources or as a result of human activities endanger human and organism health and disrupt ecosystem balance. All air pollutants have negative effects on human health and the environment; however, as defined by the United States Environmental Protection Agency's (EPA) Clean Air Act, hazardous air pollutants are toxic chemicals that cause or combine to cause severe negative impacts on human health and the environment. The EPA has classified hazardous air pollutants into five groups based on their carcinogenic potential. Benzene, one of the most dangerous pollutants in group A, is one of them. Inhaling large amounts of benzene may result in blood disorders such as a decrease in the number of red blood globules and the development of blood cancer. Furthermore, releasing pollutants into the atmosphere could result in a variety of environmental issues, such as the formation of tropospheric ozone, acid rain, and global warming [2].

Investigated the ability of photo catalytic indoor paints to reduce chemical impurities in indoor air they investigated various paints with various binder systems, such as lime, organosilane, silica sol-gel, and organic binder. The experiment focused on organic binder degradation, photo catalytic decomposition of formaldehyde, and evaluating volatile organic compounds (VOCs). The results demonstrated that the organic binder in the photo catalytic paint degraded. Stable compounds such as acetaldehyde and ketones were also produced. These compounds are fairly stable indoor air pollutants that may degrade air quality. To prevent the formation of these undesirable compounds, the binder must be sufficiently stable against active radicals.

***Address for Correspondence:** Mohamed Rehim, Department of Analytical Chemistry, Stockholm University, Frescativägen, Sweden, E-mail: mohamed-abdelrehim@gmail.com*



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The efficiency of benzo-[a]-pyrene (BaP) removal over the surface of various minerals and acrylic latex photocatalytic paints was investigated. They reported that the efficiency varied depending on the type of paint used. Organic paints were found to be more photoactive in BaP decomposition than minerals, according to this study. The minerals' photocatalytic activities were hampered by the presence of potassium and high CaCO3 contents. They discovered that potassium reacted with sulfites, limiting access to $TiO_2$'s active Anatase phase. CaCO3 also competed with $TiO_2$ for pollutant adsorption due to its porous structure [3].

UV irradiation has been shown in studies to destroy organic contaminants and oxides such as NO, $NO_2$, and $SO_2$ at low concentrations. However, the application of photocatalytic paints is still being researched. Self-decomposition of the organic components of the paint may occur during photocatalytic oxidation in long-term UV light exposure. Some research has also been conducted on the potential release of nanoparticles from photocatalytic paints into the environment, which has been identified as a source of contamination in and of itself [4].

## Description

First, an ultrasonic homogenizer was used to disperse Nano $TiO_2$ and/or $TiO_2$ pigment in distilled water. The dispersant was then added in 25:1 and 10:1 proportions to the aqueous solutions containing the pigment and Nano $TiO_2$, respectively. For $TiO_2$ pigment and Nano particles, sonication was continued for 15 and 30 minutes at 30 W, respectively. Finally, using NaOH, the pH was adjusted to 9-10.

In fact, because the samples containing Nano particles did not scatter the light, the same trend could not be expected for the $TiO_2$ containing samples. They did, however, show colour differences in the* (red-tendency) and b* (yellow-tendency) values. The samples containing Nano particles had a positive b* value, indicating a light yellow colour, but after UV irradiation and PCO activity, the colours became paler. Because of the presence of the pigment, the samples containing $TiO_2$ pigments appeared very light blue, but after PCO activity, they also appeared deeper blue [5].

## Conclusion

The semiconductor promoted the transfer of electrons and holes formed by PCO activity in the polymer matrix and compensated for pigment and Nano particle agglomeration. As a result, this sample had a higher conversion rate. The polymer was also degraded by the hydroxyl radicals formed by PCO activity, resulting in a loss of mechanical properties. It should be noted that the water glass itself improved the samples' tensile strength prior to UV irradiation.

## Acknowledgement

None.

## Conflict of Interest

There is no conflict of interest by author.

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