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## IMPACT OF THE PROCESS OF POLYMERIZATION OF POLYOL AND TOLUEN DIISOCYANATE ON THE ENVIRONMENT

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### Abstract

The aim of this study was to investigate the impact of the process of polymerization of polyol and tolyendiisocyanate on the environment. Toluene diisocyanates are important industrial intermediates used in conjunction with polyether and polyester polyols as coreactants polyurethane foams, paints, varnishes, elastomers and coatings. This presentation summarizes existing information on the release and behavior of the process of polymerization of polyol and toluen diisocyanate on the environment. A major reaction of TDI in the environment is formation of solid inert polyureas from reaction with water. In use, TDI is reacted with polyols to form many different polyurethane products. Polyurethanes have been show to be stable in the environment and in disposal have no adverse impact on municipal waste handling processes, landfills or incineration.

### Introduction

The industry “Vapex” in Čačak is the manufacturer of polyurethane foam. TDI-based polyurethane foams are widely used in the automotive and furniture industries and packaging and insulation. TDI and products containing unreacted TDI are potentially hazardous materials. Toluene diisocyanates released into the environment, will tend to partition into water and undergo rapid hydrolysis (half-life of 0,5 seconds-3 days in water, depending on pH and water turbidity) leading predominantly to the formation of relatively inert polymetic ureas.

### Experiment

Toluene diisocyanate (TDI) are synthetic organic chemicals with a molecular formula of  $C_9H_6N_2O_2$ ; a relative molecular mass of 174,17; and the following chemical structure ( $R=N=C=O$ ). Toluene diisocyanates are produced as 2 isomers (2,4-toluene diisocyanate (2,4-TDI) and 2,6-toluenediisocyanate(2,6-TDI). Toluene diisocyanates are colourless liquids or crystals, turning pale yellow on standing, and having a characteristic sharp pungent, sweet, fruity odour. **Toluene diisocyanates also react with (-NH)-containing compounds to form ureides or ureas.** The reaction of polymerization pathway is important in terms of the health hazard potential associated with toluene diisocyanates, as well as commercially, and occur at room temperature.

Toluene diisocyanates are reactive intermediates that are used in combination with polyether and polyester polyols to produce polyurethane products [1,2]. The production of flexible polyurethane foam represents the primary use of toluene diisocyanates (~90% of the total supply). The 80:20 mixture is used in their production at an average of

30 % by weight. Reactions with some of these products may be violent, generating heat, which can result in an increased evolution of TDI vapor and the formation of CO<sub>2</sub>. Polyurethane coatings represent the second largest market for toluene diisocyanates [3,4]. Toluene diisocyanates are also used in the production of polyurethane elastomeric casting systems, adhesives, sealants and other limited uses.

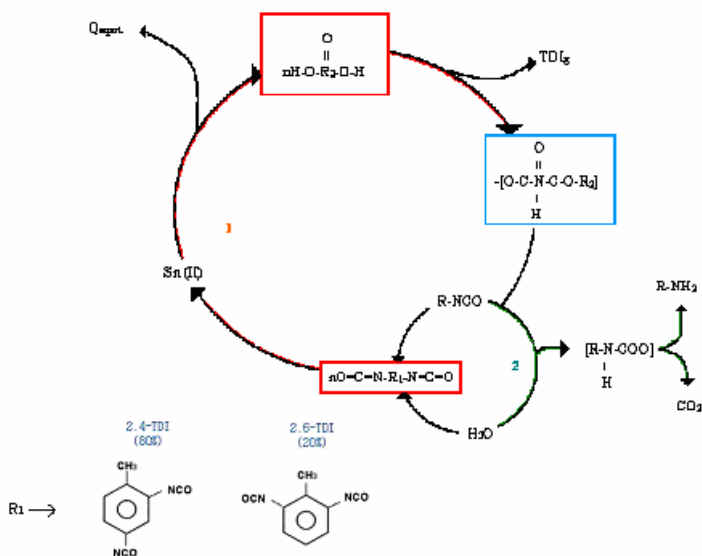


Fig. 1. Process polymerization polyol and toluene diisocyanate

## Result and Discussion

Toluene diisocyanates would also be expected to undergo photolysis and hydroxy radical oxidation. In the gaseous phase, TDI vapour and water vapour do not react to form diaminotoluenes. A rate of loss is about 20% of TDI-vapour per hour could be explained by surface adsorption. This rate of loss was much higher and more rapid when comparable concentrations of an aliphatic amine were simultaneously present in the chamber. In the industrial “Vapex”, toluene diisocyanates are hydrolysed by water to give the corresponding polymeric ureas and carbon dioxide. Absorption of toluene diisocyanates through the respiratory tract is suggested by:

- Their high acute toxicity for animals via inhalation
- Reports on systemic effects and antibody formation in individuals exposed to toluene diisocyanates primarily via inhalation

Toluene diisocyanates are very toxic for animals. TDIs, ingested orally or in contact with the skin, are relatively less toxic in terms of lethal dose. Liver, kidney and skin damage occur via these routes. Toluene diisocyanates are irritants for the mucous membranes of the respiratory tract, eyes and skin and are sensitizers of the respiratory tract and skin. Dermal application of toluene diisocyanates in one animal model resulted in sensitization, and subsequent bronchial challenge produced a hypersensitive response.

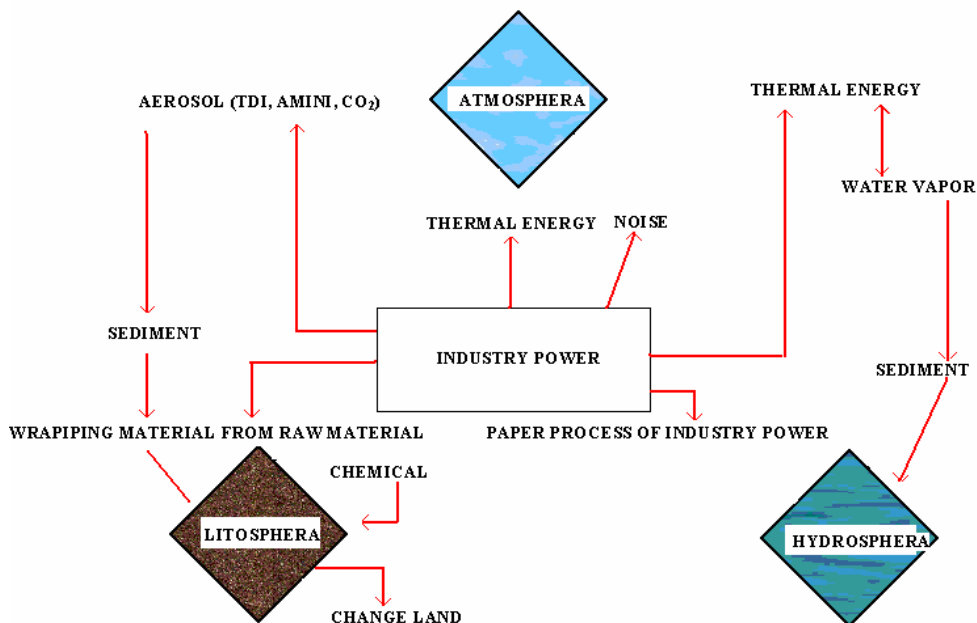


Fig. 2. Impact on industry “Vapex” Cacak

## Conclusion

To come to a conclusion, exposure to toluene diisocyanates can lead to adverse effects on the respiratory tract, skin, eyes and gastrointestinal tract. The risk of respiratory toxicity from repeated exposure can be summarized as follows:

- Chronic loss of ventilatory capacity, as measured by forced expiratory volume and forced vital capacity
- Immediate and/or delayed asthmatic responses.

Toluene diisocyanates may react with naturally occurring proteins or polysaccharides and form immuno hapten complexes.

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