Triclosan: A Polyvalent, Controversial Compound

Pharmaceuticals and Personal Care Products (PPCPs):

Triclosan

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Abstract

This project focuses on the effects of triclosan in the environment. Triclosan is a widely used antibacterial agent that is frequently found in different environmental strata. The goal of this project is to review existing literature regarding the environmental fate and transport of triclosan and the potential for environmental health effects at low concentrations. Our purpose is to assess the potential for triclosan to interact with other chemicals in the environment that exert health effects through common mechanisms of action.

Introduction

Pharmaceuticals and Personal Care Products (PPCPs) include numerous chemical substances, such as prescription and over-the-counter therapeutic drugs, veterinary drugs, cosmetics, and fragrances. Numerous studies have demonstrated the occurrence of PPCPs in water systems. Further evidence suggests that many of these products are capable of causing ecological harm and have the potential to negatively impact human health (1). Antibiotics are generally designed to inhibit bacterial growth and proliferation. These drugs constitute a significant portion of PPCPs in water supplies. Along with human use, antibacterial treatment is common in veterinary medicine, especially in mastiphylia. Antibacterial and antifungal agents are also considered antibiotics as they are designed to inhibit bacterial growth. Triclosan is a synthetic antifungal agent that is commonly used in consumer products, including soaps, hand sanitizers, toothpaste, deodorants, textiles, shoes, and toys.

• In 1972, triclosan was first used in the health care industry (2).
• Between 1976 and 2001, the United States Patent and Trademark Office issued over 2,900 patents containing the word “triclosan” (3).
• A recent FDA Consumer Update reveals that the agency has not received any evidence that triclosan provides an extra benefit to health when added to certain consumer products such as hand soap (4).
• The dramatic increase in the number of household products containing triclosan has raised concerns of the impact on human health and the environment (Figure 1).

Fate and Transport

Triclosan is lipophilic and resists environmental degradation. Its tendency to adsorb to soil and other environmental sediments increases its potential to bioaccumulate in plants and aquatic organisms. Triclosan is among the most commonly identified PPCPs in water systems. Figure 3 illustrates the fate and transport of triclosan in the environment.

Figure 3: Triclosan Environmental Fate and Transport

Potential Environmental Health Effects

The widespread use of consumer products containing triclosan has raised concerns regarding its compound’s potential impacts on the environment and human health. Recent studies demonstrate that triclosan’s structural resemblance with non-steroidal estrogens makes the compound a probable endocrine disruptor. Furthermore, UV-exposure heat readily converts triclosan into various chlorinated dibenzodioxins (15).

Triclosan Affects Sex and Thyroid Hormones Pathways

Table 2: Hormone Pathways Impacted by Triclosan

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Concentration/Dose</th>
<th>Species/Cell Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhibits estrogenic gene activity</td>
<td>10µM</td>
<td>MCF7 human breast cancer cells(20)</td>
</tr>
<tr>
<td>Decreases testosterone-induced CAT reporter gene activity and inhibits transcription activity induced by testosterone</td>
<td>10µM</td>
<td>S1151 + Mous mammary tumor cells(20)</td>
</tr>
<tr>
<td>Impairs LHR-induced testosterone production</td>
<td>5µM</td>
<td>Rat Leydig Leydig cells(21)</td>
</tr>
<tr>
<td>Increases adrenal weight and early vaginal opening</td>
<td>4.69mg/kg</td>
<td>Sheep (22)</td>
</tr>
<tr>
<td>Suppresses serum thyroxine (T4) concentrations</td>
<td>30mg/kg</td>
<td>Rat (20)</td>
</tr>
</tbody>
</table>

Key Points

• Exposure to triclosan is widespread in the U.S.
• There is a potential for triclosan to interact with other endocrine disruptors in the environment to produce additive or synergistic effects.
• The FDA is currently reviewing new evidence about the potential harm of triclosan.
• The FDA has not received evidence that triclosan provides any extra health benefit when added to certain consumer products such as hand soap.

REFERENCES

10.北美 Pharmaceuticals and Personal Care Products (PPCPs) Fact Sheet Questions Answered. EPA/841-F-03-001, November 2003.
17. Pharmaceuticals in grille water: Occurrence, fate, and transport in pristine and urban water systems. J. Environ. Monit., 6, 1453-1457.

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