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PH 290 Global Occupational Health

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IOHSAD - Chemicals in Cleaning Factories

To begin the project, I conducted literature reviews on each chemical to identify what resources were out there, how ubiquitous they are in the cleaning industry, and what adverse health effects they could illicit.

I started by researching Triclocarban and focused on the toxicity, epidemiology, and occupational health research found using www.webofscience.com, a search engine for journal publications and articles, and www.toxnet.nlm.nih.gov, a search engine that contains data from the United States National Library of Medicine Toxicology Data Network. After reading and note-taking on several abstracts, papers, and results about triclocarban use in cleaning products and endocrine disruption effects, it was apparent that most of the literature focused on animal model toxicity and consumer exposures from using triclocarban exposures. Little to no data were available on occupational exposures and outcomes from workers handling this ingredient. These papers would be useful for IOHSAD to read but I did not want to simply provide them a reference sheet for this data gathering project.

I brainstormed the ideal deliverable for this project and decided I should start by making a chemical fact sheet about the potential dangers working with these chemicals. I reached out to Nadia about the idea and asked if this would be most relevant to them and if they had any additional information for the project. After not receiving a response, I took it into my own hands and came across the CDC's Emergency Preparedness and Response Facts About Benzene page. From this, **I decided to create comprehensive and concise Chemical Hazard Fact Sheets about each chemical that detailed the following:**

1. What is it?
2. Where is it found and how is it used?
3. How you could be exposed? (occ or nature)
4. How it works? (toxicology)
5. Immediate signs and symptoms of exposure to the chemical
6. Long term health effects
7. How you can protect yourself, and what to do if you are exposed
8. How poisoning is treated
9. How you can get more information (external links/sources)

(See Appendix B for Chemical Fact Sheets)

Although the CDC references these questions for emergency preparedness and response, I believe it was most suitable in context of occupational health. IOHSAD and the workers only knew of the name of each chemical and I was told there were general complaints about the chemicals they worked with. **Through these Chemical Hazard Fact Sheets, I hoped to educate workers on their exposures, help them explain how these chemicals can cause adverse health effects, and how to better prepare and protect themselves from exposures (Appendix B).**

Investigating Smartenz 2315 and Acusol 420N

Two of the six chemicals Nadia provided me with had limited public information available, Smartenz 2315 and Acusol 420N Polymer, whereas the other four were relatively easy to research. These chemical names represent trademark chemical mixtures found on the DuPoint and Dow company websites. Smartenz 2315 is a mix of enzymes used for detergents and cleaning solutions. However, no public data were available on the chemical ingredients of Smartenz 2315. Similarly, Acusol 420N Polymer had limited data available on the physical properties of the product, with no relevant information on ingredients and health effects.

In the United States, companies are mandated to provide their workers with Safety Data Sheets (SDS) for every chemical they work with and the SDS should have all relevant information I needed for my fact sheets. I requested for the SDS of Smartenz 2315 from DuPoint

and Acusol 420N from Dow using an alias to prevent blockades from being a Berkeley student. I only received the SDS from Acusol 420N and used this to create my Chemical Hazard Fact Sheet. Although I did not hear back from DuPoint, I conducted a literature search on enzyme exposures in occupational settings and found relevant information to create a generalized Chemical Fact Sheet on enzyme exposure.

Poster Alerts

After creating the Chemical Hazard Fact Sheets, I realized most of the written material contained toxicology and industrial hygiene language that may be hard to understand for the layperson. Therefore, I decided to add a second arm to my project and **developed an infographic to help communicate more colloquially the hazards, symptoms, and preventive controls from working with these six chemicals (Appendix C).**

My goals were to make an artistic, informative, and understandable poster for IOHSAD and workers. In order to accomplish the artistic goal, I hand drew graphics for the poster and designed the rest using Adobe Photoshop. Information on each chemical was made more succinct by focusing on the toxicologic properties and health effects. Symptomatology was included in order to help workers identify how adverse health effects may relate to their occupational exposures. Controls were added as a call to action for workers to mitigate their exposures. Lastly, I leveraged my network of friends who were native-born Filipinx and asked for their help in translating the poster into Tagalog, one of the official languages of the Philippines. Translating the toxicology (endocrine disruption), nuanced health endpoints (skin sensitization) and control measures provided limiting and instead, we used more colloquial language to present this information. For instance endocrine disruption was translated to “Upand maputol ng mga hormones” (to disrupt hormones), skin sensitization to “talagang masama

pamumula ng balat” (extreme reactions on the skin), and engineering controls to “sa pamamahala ng inhinyero” (of the engineers control).

Part 3 - Nadia’s Response / Project Benefits for IOHSAD

Nadia notified me that the survey has not yet been formally started but they are hoping to start soon and sent background information on the workers (Table 1). After reviewing the information, I realize these workers are not only experiencing hazardous chemical exposures, they are also experiencing wage theft, high turnover, ergonomic hazards, and major health and safety issues.

Table 1. Background information on cleaning factory workers

Company products	Hair shampoo and conditioner, Laundry soap (Bar), Detergent powder, Fabric conditioner, Dishwashing liquid
Number of Women Workers	241
Number of Men Workers	252
Number of Working Hours	12 hours, 6:00 a.m. – 6:00 p.m.
Wages	Working in the company for 6 months+ : PhP 396.50 / day or (\$8/day) Working in the company for 5 months and below : PhP 373.00 / day or (\$7.5/day) Working in the company for 5 years+ : PhP 400 – PhP420 / day or (8.50/day)
Contractual workers	500+ workers (there are newly hired workers) Only 100 workers are regular.

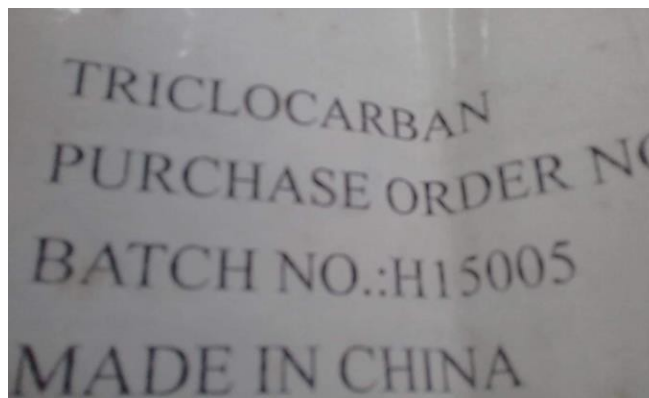
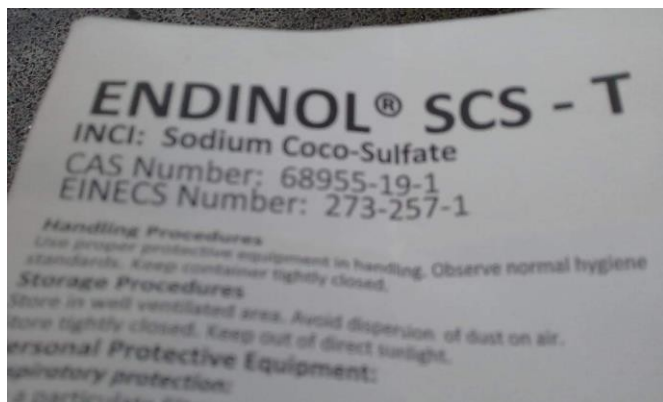
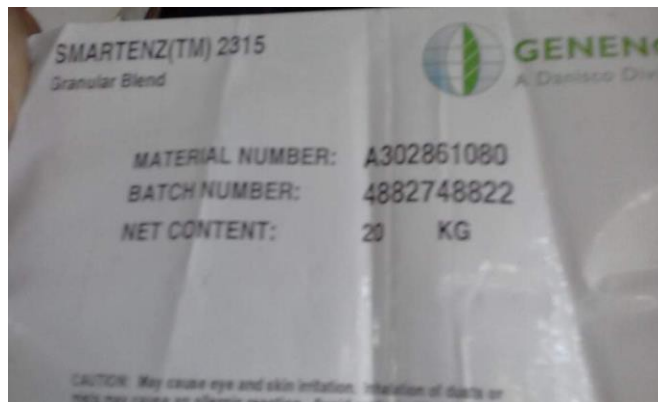
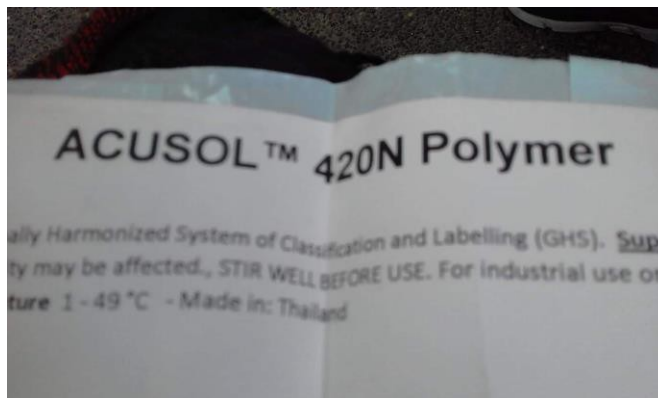
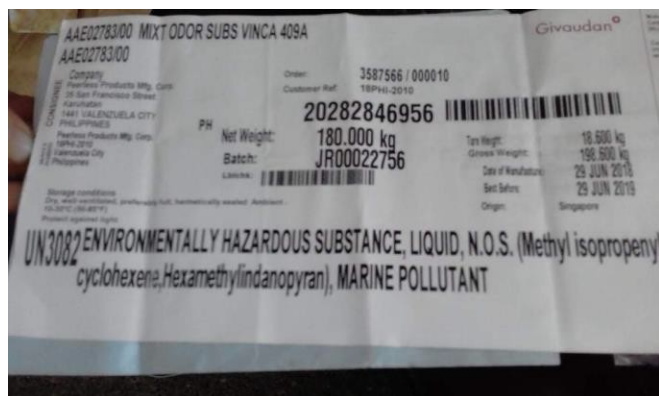
<p>Issues confronted by the workers</p>	<p>Different wages set based on the workers' length of service</p> <p>There are times when the management does not give the full amount of wages.</p> <p>Workers are overworked.</p> <p>Workers carry heavy loads (50 kg for male workers and 9kg – 14kg for women workers)</p> <p>Workers are exposed to chemicals and inhale foul/ bad odor in the workplace all the time.</p> <p>Dust in the workplace (especially in the mixing section)</p> <p>Noisy environment and machines</p> <p>No PPE's are given</p> <p>No proper ventilation</p> <p>High temperature in the workplace</p> <p>No company doctor and nurse only Human Resources personnel distribute medicines to workers who need them</p> <p>No clinic in the workplace</p>
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Chemical hazards are just the tip of the iceberg of injustices these workers face. After creating the material and only recently receiving the background information in Table 1, it has come to my attention that there are long latency periods between exposures and reproductive health endpoints or potential cancers. Therefore, in combination with the higher proportion of new workers to old workers, I do not believe this worker population truly understands the impact of these chemical exposures on their health. For instance, these workers report that there is constantly dust in the workplace, a foul/bad odor, and no proper ventilation. This leads to my conclusion that these workers suffer chronic chemical exposures with little to no agency to change their situation.

This project started as a vague idea to collect data on six chemical hazards. The project I have finished so far for the Global Occupational Safety Course has turned into more than just

data collection. **I believe that the Chemical Hazard Fact Sheets and Poster Alerts will be instrumental as a call to action to the workers to advocate for better workplace health and safety.** The information I collated will serve as guides for IOHSAD to further investigate the impact of these chemical hazards, chronic exposure, and related health endpoints. This shortens the administrative time they would have gone through from a literature search, investigating unknown and company trademark mixtures, and translating the information into colloquial language. Ideally, this would create a snowball effect and motivate IOHSAD to being this worker population's agents of change and pressure management to better protect their employees. As a result, **I hope to assist IOHSAD in developing a comprehensive survey to administer to workers and document the workplace injustices in a comprehensive guidance document for workers and management.**

Appendix A: Chemical Pictures (6)



Appendix B: Chemical Fact Sheets (6)

See next page

Acusol 420N polymer Chemical Fact Sheet

What is it?

The Acusol 420N polymer is a liquid mixture with a specialized formula of polymers to be used as an industrial detergent from Dow chemicals. After obtaining the SDS from Dow chemical, Acusol 420N contains sodium polyacrylate, residual monomers, and water.

Sodium polyacrylate is a polymer made up of long chains of repeated acrylic acid subunits joined together. In water, it becomes a super-absorber that takes up huge amounts of water and becomes a gel like state.

Residual monomers are the result of polymerization efficiency. Polymers are synthesized from monomers and rarely does 100% polymerization efficiency occur. Therefore, we can assume the residual monomers are leftover polyacrylic acid monomers.

Acrylic acid is the most basic form of the polyacrylate chemical. It is listed as a class 3 carcinogen by IARC and has only shown carcinogenic effects in animals and not humans.

Where is it found and how is it used?

Sodium polyacrylate and polyacrylic acid is found in fake snow, disposable diapers, and detergent. In detergents, it is used as a sequestering or chelating agent that binds to hard metal elements such as magnesium, calcium, iron, and zinc to make laundry work more effectively. Using this in garment work allows cleaning and neutralizing odors in clothes more effective.

Professional garment workers will manually measure out the required volume of the product and add it into a washing machine prior to washing laundry. Once washed, the polymer should be removed during the process.

How you can be exposed to it (occ or nature)

Exposure mainly comes from water vapors and off-gassing as smartenz is in a liquid state. Routes of exposure can be through inhalation, ingestion, or dermal contact.

Inhalation of Acusol is unlikely given the low vapor pressure ($<1.3 \times 10^{-9}$ kPa). However, in poorly ventilated areas, off-gassing is possible. If inhaled or ingested, remove worker from exposure source and observe for any adverse effects.

Dermal exposure is most likely during measuring and dispensing of laundry product. Wash affected areas thoroughly with soap and water.

How it works? (tox)

As a polymer of high molecular weight (>1000 Da), it is unlikely to cross cell membranes and cause systemic toxicity. However, the most basic form, acrylic acid, is highly toxic and may be more useful to assess.

Acrylic acid will cause coagulation necrosis. This occurs when hydrogen ions attack epithelial cells and cause tissue necrosis to form ulcers. Oral toxicity of this chemical may cause irritation or superficial or deep edema, blisters, ulcerations, or burns of the oropharynx, esophagus, and stomach. Severe oral toxicity may lead to fistula formation, perforation, and gastrointestinal bleeding. The most common symptom is upper airway edema and can be life threatening.

Inhalation may cause pleuritic chest pain, cough, and bronchospasm. Severe inhalation may lead to upper airway edema and burns, hypoxia, pneumonitis, and rarely acute lung injury or pulmonary function abnormality. Asthma is a most common symptom.

Exposure to the eyes may lead to severe conjunctival irritation, corneal epithelial defects, permanent vision loss, and sometimes perforation in extreme cases.

Dermal exposure may lead to irritation and partial thickness burns. High exposure can lead to full thickness burns, sepsis, and systemic toxicity.

Chronic inhalation exposure in animals has been reported to cause lethargy, weight loss, kidney abnormalities, embryotoxicity, and inflammation to the upper respiratory tract and gastric mucosa.

Immediate signs and symptoms

If exposure is certain, immediate signs of toxicity are skin, stomach, or eye irritation. Prolonged exposure may lead to blindness, rashes, or difficulty breathing and present as asthma. If these symptoms worsen, you may be experiencing internal effects.

Long term health effects

The long-term health effects of chronic exposure to Acusol 420N are not well known and no epidemiology study exists for this chemical. Most of the literature claims it to be a relatively safe chemical. However, based on the toxicity of acrylic acid, chronic exposure may lead to lethargy, weight loss, kidney abnormalities, embryotoxicity, and inflammation of the upper respiratory tract

and gastric mucosa. However, these effects have only been shown in animals and the same may not be true in humans.

How you can protect yourself, and what to do if you are exposed

Workers should be advised to wear gloves during processing and use of the chemical. Make sure to wash hands thoroughly and avoid hand to mouth contact at the workplace. Safety goggles should be worn at all times to prevent splash back and exposure to the eyes.

How poisoning is treated

Treatment data is sparse for polyacrylic acid, however, acrylic acid contains some recommendations. If an individual ingests or inhales the acid, they should immediately be sent to a health care facility for evaluation. If this is not possible, they should be moved to fresh air and monitor for difficulty breathing or coughing. If this worsens, they may be experiencing severe respiratory distress and should be transported to a healthcare facility as soon as possible.

If eye exposure occurs, they should irrigate their eyes with fresh water for at least 15 minutes. If severity continues, they should be moved to the nearest healthcare facility.

If dermal exposure occurs, they should wash the area with soap and water for 10-15 minutes.

In cases of extreme poisoning, send the patient to the nearest healthcare facility immediately.

Sources

1. <https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+6087>
2. <https://www.livestrong.com/article/127011-ingredients-colgate-total-toothpaste/?ajax=1&is=1>
3. https://www.ewg.org/skindeep/ingredient/704957/POLYACRYLIC_ACID/
4. Dow chemical SDS – obtained from calling company

Endinol - Sodium Coco-Sulfate

Chemical Hazard Fact Sheet

What is it?

Sodium coco sulfate (SCS) is a synthetic detergent, meaning it is chemically altered to imitate a natural product that cleans, like soap. It is used for its strong cleansing power and high foaming action. It appears as white needles and is a strong oxidizing agent. Toxicity of SCS includes being a category 2 skin irritant, category 1 eye damage, category 4 acute oral toxicity, category 2 acute aquatic toxicity, and category 3 chronic aquatic toxicity.

SCS is made from a blend of fatty acids from coconut oil. In some cases, sodium lauryl sulfate (SLS) is mixed in at the manufacturers discretion, and is extremely toxic by itself.

Turns out, SCS contains SLS; the difference lies in the science. The process to make SLS involves a chemical reaction that isolates one fatty acid from either petroleum jelly, coconut oil or palm oil. Whereas SCS is derived from a blend of fatty acids from coconut oil. While we all know and love coconut oil, its science lab derivatives aren't completely natural ingredients. In the blend of fatty acids that SCS is, SLS is mixed in, with amounts only at the manufacturers discretion. Additionally, SCS may be contaminated with 1,4-Dioxane which is a known human health hazard.

Where is it found and how is it used?

It can normally be found in shampoos, body washes, or toothpastes. Foaming detergents may also contain SCS.

How you can be exposed to it (occ or nature)

Mixing SCS into cleaning products exposes workers to the chemical. Additionally, using the product to clean material will expose individuals as well. As a synthetic chemical, workers and consumers are the most at risk for exposure.

How it works? (tox)

SCS is considered a safe alternative to more irritating chemicals such as SLS. However, as SCS contains some SLS and may be contaminated by 1,4-Dioxane, it can illicit toxic effects through those chemical mechanisms. SLS may strip natural oils from the skin and cause skin dryness. Limited data exists on SLS but according to the Environmental Working Group's Skin Deep Database, SLS is concerning to the skin, eyes, lungs, and organs. Additionally, it may cause skin sensitization which leads to intense allergic reactions after multiple contacts over time.

SCS, SLS, and 1,4-Dioxane belong to a larger body of chemicals known as surfactants. These endocrine disruptors cause estrogen toxicity from surfactant chemicals and have been linked to

breast cancer and reproductive health effects. Additionally, 1,4-dioxane has been shown to cause cancer, miscarriage, and stillbirths in animals and is labeled possibly carcinogenic in humans. The exact toxicity of SCS exposure is not well researched, but given its possible contaminants, SCS and 1,4-dioxane, it may be toxic.

Immediate signs and symptoms

Few or no human studies exist to identify symptoms of poisoning in humans. Workers experiencing discomfort, physiological changes, or unexplained reproductive issues should be aware that SCS/SLS/1,4-dioxane have shown similar poisoning effects in animals. Anyone experiencing these effects should avoid continual exposure to these chemicals.

Long term health effects

Chronic exposure may lead to cancer, reproductive health effects, and developmental issues. Children of workers may also experience health effects if their mothers were exposed during pregnancy.

How you can protect yourself, and what to do if you are exposed

To adequately protect yourself, workers should wear personal protective equipment such as N95 masks to screen particulates, wear gloves, and safety goggles. Proper ventilation should also be established to remove dust and aerosolized SCS from the air. Affected areas should be washed for 10-15 minutes with soap and water.

How poisoning is treated

SCS poisoning may be similar to endocrine disruption effects. In this case, normal hormone regulation will be disrupted and individuals may experience adverse reproductive health effects. Poisoning is irreversible and avoiding or protecting against personal exposure is the best protection treatment.

If eye exposure occurs, they should irrigate their eyes with fresh water for at least 15 minutes. If severity continues, they should be moved to the nearest healthcare facility.

If dermal exposure occurs, they should wash the area with soap and water for 10-15 minutes.

In cases of extreme poisoning, send the patient to the nearest healthcare facility immediately.

Sources

1. <https://amazingy.com/magazine/eye-ingredients-sodium-coco-sulfate/>
2. [https://nyponros.com/en/soap-and-other-surfactants/sodium-coco-sulfate-in-shampoo?filter_tag\[0\]=](https://nyponros.com/en/soap-and-other-surfactants/sodium-coco-sulfate-in-shampoo?filter_tag[0]=)
3. <https://www.livestrong.com/article/538086-sodium-laureth-sulfate-allergy/?ajax=1&is=1>
4. <https://www.zeroxeno.com/blog/sodium-lauryl-sulfate-vs-sodium-coco-sulfate>
5. <https://www.ncbi.nlm.nih.gov/books/NBK153666/>

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Immediate signs and symptoms

Few or no human studies exist to identify symptoms of poisoning in humans. Workers experiencing discomfort, physiological changes, or unexplained reproductive issues should be aware that SCS/SLS/1,4-dioxane have shown similar poisoning effects in animals. Anyone experiencing these effects should avoid continual exposure to these chemicals.

Long term health effects

Chronic exposure may lead to cancer, reproductive health effects, and developmental issues. Children of workers may also experience health effects if their mothers were exposed during pregnancy.

How you can protect yourself, and what to do if you are exposed

To adequately protect yourself, workers should wear personal protective equipment such as N95 masks to screen particulates, wear gloves, and safety goggles. Proper ventilation should also be established to remove dust and aerosolized SCS from the air. Affected areas should be washed for 10-15 minutes with soap and water.

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Sources

1. <https://amazingy.com/magazine/eye-ingredients-sodium-coco-sulfate/>
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5. <https://www.ncbi.nlm.nih.gov/books/NBK153666/>

Triclocarban

Chemical Fact Sheet

What is it?

Triclocarban is a triclosan analogue with an antibacterial property and presents as a fine white powder. Triclocarban interrupts cell membrane synthesis and leads to bacterial growth inhibition. When heated to decomposition, it releases toxic fumes of hydrogen chloride and nitrogen oxides. This creates an odorous environment.

It is most known for being an endocrine disruptor and causes hormone dysregulation in the human body. This can be especially toxic to reproductive organs or females and males. The FDA has banned triclocarban from being used in soaps as of 2016.

Where it is found and how it is used?

It is commonly found in household and personal care products labelled “antibacterial.”

How you can be exposed to it

As an endocrine disruptor, triclocarban can be extremely toxic to sex organs. Chronic exposure to triclocarban may result in carcinogenesis of human breast cells from non-cancerous to pre-malignant. Overtime, it can also cause reactive oxidative species in cells and lead to cell proliferation and necrosis.

Most studies have demonstrated toxicity in animals. In rats exposed to triclocarban, prostate cancer cells developed and they experienced negative health effects in androgen receptors and reproductive organs. Zebrafish is a model organism for human toxicity and studies have shown increased brain-specific expression of aromatase, altering the production of normal estrogen in Zebrafish embryos. Altered hormone regulation in animals may lead to developmental defects. In addition, reproductive toxicity and neurotoxicity have demonstrated decreased pregnancy rates, stillbirths, and cognitive issues.

Human epidemiologic studies have not been well studied for triclocarban. Dermal exposure from cleaning agents has been the biggest concern, and less data is known on human inhalation and ingestion. In occupational settings, triclocarban handling should proceed with caution.

Immediate signs and symptoms

Few or no human studies exist to identify symptoms of poisoning in humans. Workers experiencing discomfort, physiological changes, or unexplained reproductive issues should be

aware that triclocarban have shown similar poisoning effects in animals. Anyone experiencing these effects should avoid continual exposure to triclocarban.

Long term health effects

Chronic exposure may lead to cancer, reproductive health effects, and developmental issues. Children of workers may also experience health effects if their mothers were exposed during pregnancy.

How you can protect yourself, and what to do if you are exposed

To adequately protect yourself, workers should wear personal protective equipment such as N95 masks to screen particulates, wear gloves, and safety goggles. Triclocarban should be stored in cool environments to avoid toxic off-gassing of fumes. Proper ventilation should also be established to remove dust and aerosolized SCS from the air. Affected areas should be washed for 10-15 minutes with soap and water.

How poisoning is treated

Triclocarban poisoning may be near impossible to treat once it enters your system. This chemical affects normal hormone regulation and no drug protects against this. Poisoning is irreversible and avoiding or protecting against personal exposure is the best protection treatment.

If eye exposure occurs, they should irrigate their eyes with fresh water for at least 15 minutes. If severity continues, they should be moved to the nearest healthcare facility.

If dermal exposure occurs, they should wash the area with soap and water for 10-15 minutes.

In cases of extreme poisoning, send the patient to the nearest healthcare facility immediately.

Sources

1. Induction of human breast cell carcinogenesis by triclocarban and intervention by curcumin (Sood et al. 2014)
2. Chung et al. 2011 Effects of bisphenol A and triclocarban on brain-specific expression of aromatase in early zebrafish embryos
3. Duleba, Lasley et al. 2011. Effects of Triclocarban on Intact Immature Male Rat: Augmentation of Androgen Action
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5. <https://www.ewg.org/skindeep/ingredient/706622/TRICLOCARBAN/>

Smartenz 2315

Chemical Fact Sheet

What is it?

Smartenz 2315 is the trademark name of a liquid mixture of enzymes from chemical company DuPont. Although the SDS is not available, Smartenz 235 contains biological enzymes used to break down fats and oils to make an excellent additive for cleaning products.

Proteolytic enzymes are biological proteins used to catalyze and initiate chemical reactions. In terms of cleaning products, enzymes will react with fats and oils to break their chemical bonds and release them from garments.

Where is it found and how is it used?

Enzymes are typically found and used in cleaning products for its strong cleaning action and stain removal. Workers will normally add this material to cleaning solutions.

How you can be exposed to it (occ or nature)

Some reports describe enzyme mixtures package in capsules as to prevent aerosolization. However, this is not confirmed to be true in the context that these cleaning workers are exposed to.

Exposures mainly come from inhalation of aerosolized enzyme product or dermal contact. Accidental ingestion may occur if workers are eating on the job or do not properly wash hands after shifts. Inhalation will occur when ventilation is not present.

How it works? (tox)

Increased exposure to enzymes will lead to increased health effects. In general, enzymes are not directly mutagenic in humans. However, enzyme exposures are known to affect IgE antibodies to produce an inflammatory response in the body.

Ingestion presents low toxicity since food has natural enzymes.

Dermal and eye contact may cause irritation and discomfort.

Inhalation is the main exposure of concern that may cause asthmatic and allergic toxicity. Acute and chronic exposure to enzymes will cause the body to produce more antigens and increase

sensitivity to the product. This leads to sensitization and more severe reactions from continual exposure. Asthma like symptoms are also most likely to present in exposed individuals.

Immediate signs and symptoms

If exposure is certain, immediate signs of toxicity are asthmatic-like symptoms, irritation to the skin or eyes. Prolonged exposure may lead to asthma and allergic responses in the workplace. If these symptoms worsen, you may experience even stronger reactions in the future.

Long term health effects

The long-term health effects of chronic exposure to Acusol 420N are not well known and no epidemiology study exists for this chemical. Most of the literature claims it to be a relatively safe chemical. However, based on the toxicity of acrylic acid, chronic exposure may lead to lethargy, weight loss, kidney abnormalities, embrotoxicity, and inflammation of the upper respiratory tract and gastric mucosa. However, these effects have only been shown in animals and the same may not be true in humans.

How you can protect yourself, and what to do if you are exposed

Workers should be advised to wear N95 masks to filter out air particulates that may contain enzymes. Gloves and safety goggles should be worn at all times to prevent accidental exposure.

If eye exposure occurs, they should irrigate their eyes with fresh water for at least 15 minutes. If severity continues, they should be moved to the nearest healthcare facility.

If dermal exposure occurs, they should wash the area with soap and water for 10-15 minutes.

If inhaled, patients should be removed from the facility to breathe in clean air and wear a respirator to prevent workplace exposures.

How poisoning is treated

Acute and chronic effects such as general discomfort, asthma, and allergic responses may be resolved through the body's normal detoxification mechanisms and removal from the high exposure area.

Sources

1. Basketter et al. (2012) "The toxicology and immunology of detergent enzymes" *Journal of Immunotoxicology*. DOI: 10.3109/1547691X.2012.659358

Methyl Isopropenyl, Cyclohexane, Hexamethylindanopyran (Galaxolide) Chemical Fact Sheet

What is it?

Methyl isopropenyl, cyclohexane, and hexamethylindanopyran are chemical mixtures that constitute “fragrance” or “parfum” in cleaning products. Separately, these chemicals present acute and chronic toxicity when exposed. Together, these chemicals could very well cause synergistic toxicity, with mechanisms unknown.

Methyl isopropenyl is a water-white liquid used in soaps and detergents that is highly flammable. The hazard classification lists it as a flammable and known health hazard. It is a solvent used to dissolve other chemicals.

Cyclohexane is a colorless and highly flammable liquid normally used in petroleum oil and produces a pungent petroleum like odor. The hazard classification lists it as a flammable, serious health hazard, and hazardous to the environment and aquatic life. It is a solvent used to dissolve other chemicals.

Hexamethylindanopyran is also known as Galaxolide and is an almost colorless viscous liquid. The hazard classification lists it as hazardous to the environment and aquatic life. It is used for its strong pleasant odor.

Where is it found and how is it used?

The combination of methyl isopropenyl, cyclohexane, and hexamethylindanopyran creates “fragrance” and is found in almost all soap and detergent products. Methyl isopropenyl and cyclohexane are solvents that help dissolve other chemicals such as Galaxolide. It is assumed this mixture is used to dissolve chemical products in detergent and soaps to produce a pleasant odor and stable solution of chemicals.

How you can be exposed to it (occ or nature)

Occupational exposure may occur during the processing when it is added to soap, laundry, or cleaning mixtures. Dermal contact and inhalation of these chemicals are the most common exposure routes. Accidental ingestion may occur through contaminated hand to mouth contact.

How it works? (tox)

Methyl isopropenyl has relatively low toxicity but can still cause acute toxicity. Inhalation may lead to mucous membrane irritation, nausea, headache, vertigo, central nervous system depression, and cardiorespiratory failure. Exposure to the eyes may cause irritation and eye damage. Ingestion may lead to oral irritation, nausea, vomiting, metabolic acidosis, and pulmonary aspiration. Dermal exposure may lead to dermatitis or rashes.

Cyclohexane exposure presents even larger hazards given it belongs to the hydrocarbon chemical family, which also contains carcinogenicity. Inhalation may lead to irregular heartbeat, central nervous system depression, and possible asphyxiation in poorly ventilated areas. Eye exposure usually results in irritation and reversible eye injury. Ingestion can lead to organ toxicity, gastrointestinal disturbances, respiratory depression, lung dysfunction, and rare heart complications. Dermal exposure may lead to burns or frostbite depending on setting.

Galaxolide has not been comprehensively studied but still elicits toxicity following acute exposure. Generally, upon inhalation, the chemical could cause headaches, dizziness, weakness, and nausea. Asthma and wheezing could also develop. Eye exposure may lead to irritation. Ingestion could cause burns or irritation of the esophagus or gastrointestinal tract. Dermal exposure could lead to hypersensitivity dermatitis, or skin sensitization.

Immediate signs and symptoms

Symptoms of exposure are generally focused on dermal and inhalation toxicity such as skin irritation and rashes. Obvious signs of poisoning are occupationally induced asthma or wheezing, nausea or headaches, and extreme reactions after dermal exposure. Dermal exposure is most likely in the factory setting and obvious symptoms are skin irritations and rashes. If ingested, look for general gastrointestinal discomfort or severe symptoms such as vomiting, throat pain, and nausea.

Long term health effects

No chronic exposure data or endpoints exist for methyl isopropenyl but it can be assumed that acute toxicity mirrors long term health effects. Workers should be aware that constant vertigo or headaches could be caused by this.

Chronic exposure to cyclohexane can result in sudden death, encephalopathy, residual neurological impairment, nephrotoxicity, and hepatotoxicity.

Skin sensitization is the most important chronic effect of Galaxolide. Severe skin reactions or asthmatic shock is most likely to be caused by constant, low exposure to Galaxolide from dermal contact or inhalation.

How you can protect yourself, and what to do if you are exposed

Adequate use of personal protective equipment (PPE) will protect from dermal exposure. Wearing an N95 mask will only protect against dust and not from chemical exposures since gas and vapors can readily pass through the mask.

If eye exposure occurs, they should irrigate their eyes with fresh water for at least 15 minutes. If severity continues, they should be moved to the nearest healthcare facility.

If dermal exposure occurs, they should wash the area with soap and water for 10-15 minutes.

In cases of extreme poisoning, send the patient to the nearest healthcare facility immediately.

How poisoning is treated

Due to the mixture of chemicals, it is best to treat poisoning at a local healthcare facility. Acute effects such as general discomfort may be resolved through the body's normal detoxification mechanisms and removal from the high exposure area.

Sources

1. <https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+1164>
2. <https://www.eastman.com/Pages/ProductHome.aspx?product=71000196>
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5. <https://toxnet-nlm-nih-gov.libproxy.berkeley.edu/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+7514>
6. <https://pubchem.ncbi.nlm.nih.gov/compound/Galoxolide>

Appendix C: Poster Infographics (English/Tagalog)

CLEANING PRODUCT HAZARDS



CHEMICAL MAKE-UP

- | | |
|--|--|
| <ul style="list-style-type: none"> • Triclocarban
Endocrine disruptor
May cause cancer • Sodium coco-sulfate
Skin irritant • Sodium polyacrylate
Toxic to skin, eyes, and stomach | <ul style="list-style-type: none"> • Limonene
Skin sensitization that causes extreme reactions • Methyl isopropenyl Cyclohexane Galaxolide
Endocrine disruptor
Skin irritant |
|--|--|

COMMON SYMPTOMS

- Occupational-related asthma
- Skin rashes after contact with chemical
- Nausea, fatigue, and dizziness

WORKPLACE CONTROLS

- Engineering controls - proper ventilation and storage of chemicals
- Administrative controls - safe handling policies and reporting of dangerous work practices
- Personal protective controls - wear nitrile gloves, safety goggles, and N95 masks



PAGILINIS NG MGA PANGANIB NG PRODUKTO



KEMIKAL NA SANGKAP

- | | |
|--|---|
| <ul style="list-style-type: none"> • Triclocarban
Upang maputol ng mga hormones
Nakaka kanser • Sodium coco-sulfate
Pamumula ng balat • Sodium polyacrylate
Nakakalason sa balat, mata, tiyan | <ul style="list-style-type: none"> • Limonene
Talagang masama pamumula ng balat • Methyl isopropenyl Cyclohexane Galaxolide
Upang maputol ng mga hormones
Pamumula ng balat |
|--|---|

ANONG IYONG INARARMDAMAN

- Hika bakahikain
- Pamumula ng balat
- Nagsusuka, napapagod, nahihilo

MGA KONTROL SA LUGAR NG TRABAHO

- Sa pamamahala ng inhinyero - tamang bentilasyon, silid kemikal
- Administrasyon kahulugan - ligtas na pamaraan
- Mga personal na proteksyon - isusuot guwantes ng nitrile, maskara N95, kaliglasan salaming de kolor

