**Research Title :** The Study of microplastic types in soil in rice paddy fields (wet-season rice) that have been flooded during the monsoon season.

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## Abstract

The study of microplastic types in the soil of rice paddies (wet-season rice) that have been flooded during the monsoon season involved chemical and microplastic analysis of the samples. These were divided into five key points where various substances related to different industries were identified. At Points 1, 2, and 5, substances commonly found in multiple occurrences include Diatomaceous Earth, Polydimethylsiloxane, Kaolin, and Chromium(VI) Oxide. These reflect usage in various industries, including adsorption of substances and contamination from silicone products and agricultural chemicals. At Point 3, microplastics were found to be contaminated with Rayon Fiber, Niobium(V) Oxide, Tantalum(V) Oxide, and Cellulose, indicating the potential contamination of microplastics in the sample. At Point 4, several chemicals used in manufacturing processes were found, including Gitan 770, EFKA 3236, Guar, Florisil, and Methylthiophosphonic Dichloride. These chemicals are used in the rubber industry, chemical separation, and agricultural chemical production. At Point 5, other compounds were identified, such as Bentonite Sample B, Ferric Hydroxide, and various silicone chemicals like Tetraallylsilane and Silicone Oil, High Temperature, which are used in manufacturing processes and machinery that require high heat resistance. This study provides insights into chemical and microplastic contamination in the samples, as well as the use of chemicals in various industries.

## Introduction

Rice farming in Thailand, particularly the traditional wet-season rice cultivation (napi), relies heavily on rainfall. The farming cycle begins in the early rainy season (approximately May to July) and harvesting takes place toward the end of the year (October to December). This system is deeply embedded in the livelihoods of Thai people, especially in the central, northern, and northeastern regions, which are large rice-growing areas. Wet-season rice farming is thus a crucial foundation of Thai agriculture and an integral part of the nation's economy and culture.

In recent years, the issue of microplastic contamination in agricultural ecosystems has gained significant attention, especially in flooded rice paddy fields, where water levels are continuously managed to support plant growth. Wet-season rice farming requires substantial amounts of water, resulting in prolonged water saturation in the fields. This has a variety of impacts, particularly on soil quality and the accumulation of microplastics in rice paddy areas. The contamination of microplastics in rice paddies can stem from multiple sources, such as agricultural plastics, plastic mulches, irrigation pipes, plastics in fertilizers or soil conditioners, runoff from rivers or irrigation canals, and airborne dust. There is a tendency for microplastics to accumulate from water sources that flow through these fields.

The accumulation of microplastics in rice paddies may affect soil quality, agricultural ecosystems, rice yield, and food safety, potentially leading to long-term health risks. Consequently, the research team recognizes the significant impact of this issue. The study of microplastic types in soils from rice fields that have been flooded during the monsoon season is crucial. This research will help identify the level of microplastic contamination in agricultural systems, which affects the ecosystem and soil quality. The findings will provide essential data for developing policies and strategies to manage plastic pollution in agriculture, helping to prevent environmental and food safety issues in the long term.

**Objective**

Study of microplastic types in soil of rice paddies (wet-season rice) that have been flooded during the monsoon season.

**Research question**

Do the types of microplastics found in the soil of rice fields (wet-season rice) that have been flooded during the monsoon season differ?

**Hypothesis**

The soil in rice fields (wet-season rice) that have been flooded during the monsoon season is contaminated with microplastics.

## Experimental Method

**3.1 Experiment step 1** Collect soil samples

1. Define the soil depth range as 10 cm.
2. Collect soil samples in containers free from contamination.

**3.2 Experiment step 2** Prepare the samples

1. Dry the soil by air-drying or drying it in a hot air oven at 60°C for 20 hours to remove moisture.
2. Sieve the dry soil using a sieve to separate large particles and focus on small particles.
3. Remove organic substances using hydrogen peroxide (H2O2) to oxidize and eliminate organic matter.

**3.3 Experiment step 3** Separate microplastics

1. Mix the soil with a saturated sodium chloride (NaCl) solution (density > 1.6 g/cm³).
2. Mix and allow heavier particles to settle while the lighter microplastics float to the surface.
3. Separate the floating particles and filter through a fine mesh or filter (e.g., 0.45 μm).
4. Place the residue on a filter paper and dry in an oven at 60°C for 2 hours.

**3.4 Experiment step 4** Analyze microplastics

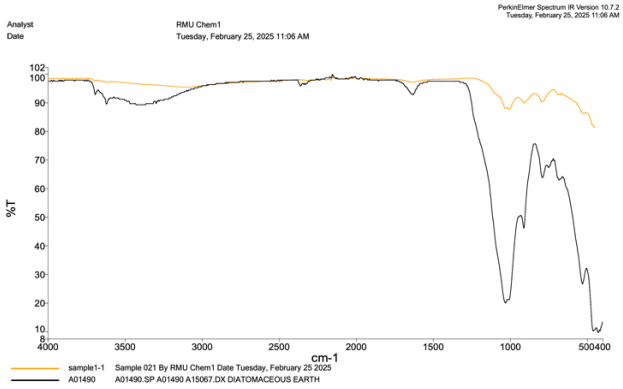
1. Analyze using FTIR (Fourier Transform Infrared Spectroscopy) to identify polymer types by detecting the infrared spectrum.

## Materials and Equipment

1. Soil samples from the target area
2. Balance
3. Hydrogen peroxide (H2O2) solution, concentration
4. Saturated sodium chloride (NaCl) solution (density > 1.6 g/cm³)
5. Oven
6. FTIR (Fourier Transform Infrared Spectroscopy) machine

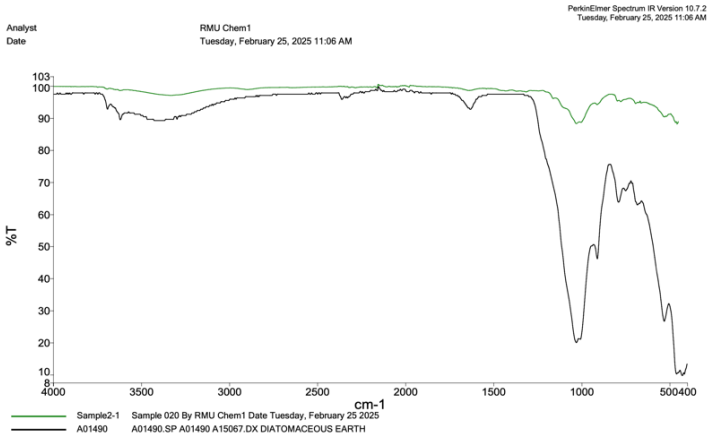
## Results

### Coordinates of hole 1 16.43640° N, 103.53306° E



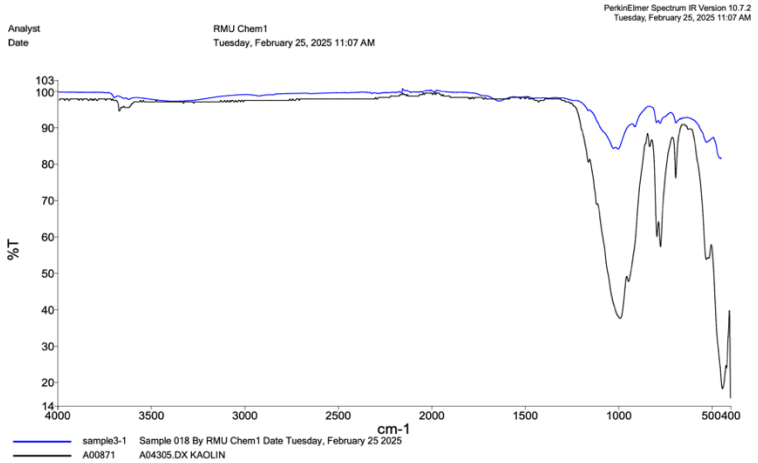

Polydimethylsiloxane (PDMS), a silicone possible contamination by silicone. Kaolin, a type of clay mineral while Chromium(VI) Oxide appeared as a chromium compound

### Coordinates of hole 2 16.43629° N, 103.53281° E



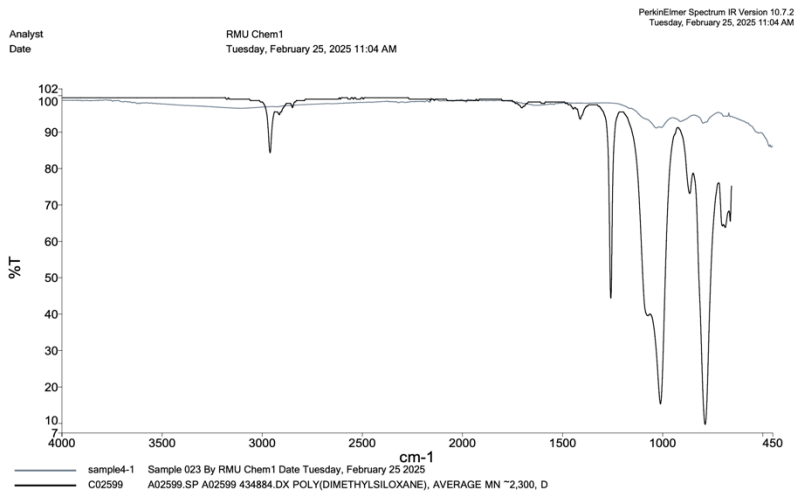

Polydimethylsiloxane (PDMS), a silicone compound, appeared multiple times in the list, suggesting possible contamination by silicone. Kaolin, a type of clay mineral, was observed in several instances, while Chromium(VI) Oxide appeared as a chromium

**Coordinates of hole 3 16.43612° N, 103.53260° E**




microplastics were identified as follows: Rayon Fiber appeared repeatedly, indicating the potential presence of rayon fibers in the sample. Niobium(V) Oxide was identified as a niobium compound, and Tantalum(V) Oxide was found as a tantalum compound. Additionally, Cellulose was detected.

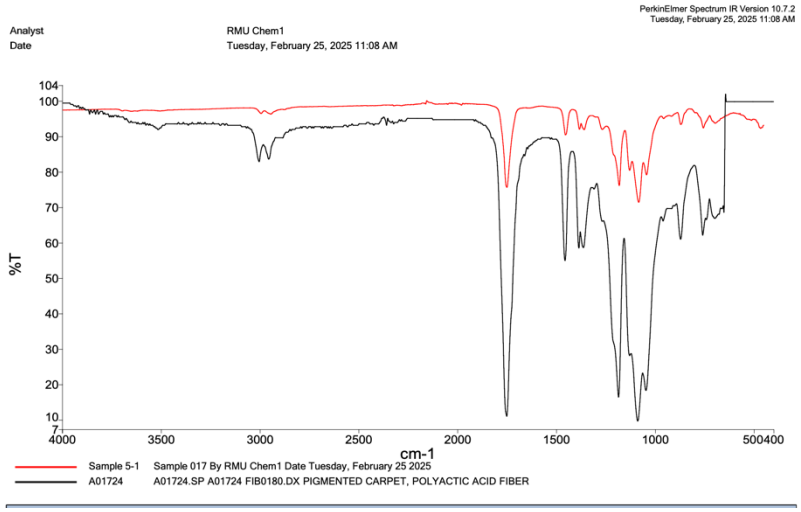
**Coordinates of hole 4 16.43649° N, 103.53302° E**




microplastics were identified as follows: Gitan 770 recorded the highest "Search Score" (0.592357), followed by EFKA 3236 and Guar , which are chemical compounds. Florisil , a commercial product name, and Methylthiophosphonic Dichloride were also identified. Bentonite Sample B and Ferric Hydroxide were detected as inorganic compounds, along with BYK 322 and Kaolin. Further, Tetraallylsilane , 5-Chloro-2-(Trichloromethyl)benzimidazole , 1,7-Dichloro-Octamethyltrisiloxane, and Silicone Oil, High Temperature were also found,

which are compounds associated with high-temperature processes and silicone-based products.

**Coordinates of hole 5 16.43670° N, 103.53306° E**




Polydimethylsiloxane (PDMS), a silicone compound, appeared multiple times in the list, suggesting possible contamination by silicone. Kaolin, a type of clay mineral, was observed in several instances, while Chromium(VI) Oxide appeared as a chromium

This analysis provides a comprehensive identification of various chemicals and microplastics present in the samples, highlighting the potential sources and types of contamination in the agricultural ecosystem.

**Summary and Dicussion**

Points 1, 2, and 5 (Substances identified multiple times): Diatomaceous Earth recorded the highest similarity "Search Score" (0.826936), indicating that this sample closely resembles diatomaceous earth, which is primarily composed of silica and is known for its absorbing and filtering properties, making it widely used in various industries. Poly (dimethylsiloxane) (PDMS), a silicone compound, appeared several times in the list, suggesting the possibility of silicone contamination in the sample. Silicone is widely used in industrial and medical products. Kaolin, a type of clay mineral, was observed multiple times in the list and is used in industries such as cosmetics, ceramics, and medicine. Chromium(VI) Oxide is a chromium compound in the +6 oxidation state, which is highly toxic and used in various industries, including metal coating and pigment production. Point 3 (Microplastic detection) Rayon Fiber** appeared multiple times, indicating a possible contamination by rayon fibers, which is a type of microplastic. Niobium(V) Oxide, a niobium compound, was

identified, and Tantalum(V) Oxide , a tantalum compound, was also found. These metals are used in industries such as aerospace and electronics. Additionally, Cellulose , an organic compound found in plants, was detected, and it can be used to produce biodegradable plastics or other eco-friendly products. Point 4 (Identification of various chemicals): Gitan 770 recorded the highest "Search Score" (0.592357), which may indicate its use in production processes. EFKA 3236 is a chemical used as an additive in certain production processes, such as improving the properties of rubber. Guar , an extract from the guar seed, is used in the food and cosmetics industries. Florisil is an adsorbent used in chromatographic processes and chemical analyses. Methylthiophosphonic Dichloride is a phosphorus-based chemical used in pesticide and chemical production. Point 5 (Identification of other compounds) Bentonite Sample B  is a type of clay with absorption properties and is used in various industries, such as oil drilling. Ferric Hydroxide , a compound of iron, is used in wastewater treatment processes. Kaolin reappeared in the list, confirming its use in the sample. Tetraallylsilane is a silicone compound used in the chemical industry. Other chemicals found include 5-Chloro 2 (Trichloromethyl) Benzimidazole , used in the pesticide industry, and 1,7-Dichloro-Octamethyltrisiloxane , a silicone compound used in the chemical industry. Silicone Oil, High Temperature , used in industrial machinery and equipment for high-temperature resistance, was also detected. The analysis you provided reveals a broad range of chemicals related to various industries, including the presence of microplastics, which may have resulted from contamination in the samples. Particularly in Point 3, where microplastics (Rayon Fiber, Niobium Oxide, and Tantalum Oxide) were found, it indicates the likelihood of contamination from plastics. Additionally, common industrial chemicals, such as silicones and agricultural chemicals, were also identified.

**Discuss the esults of the experiment**

Points 1, 2, and 5 (Substances identified multiple times) Diatomaceous Earth is the most frequently found substance in the sample, known for its absorbing and filtering properties, widely used in various industries. Poly (dimethylsiloxane) (PDMS) is a silicone compound identified multiple times, which may indicate contamination from silicone used in industrial and medical applications. Kaolin , a type of clay, is used in the cosmetics, ceramics, and medical industries. Chromium(VI) Oxide is a highly toxic substance used in metal coating and pigment production. Point 3 (Microplastic Detection): Rayon Fiber is a microplastic that may be a result of contamination. Niobium(V) Oxide is a metal used in the

aerospace and electronics industries. Tantalum(V) Oxide is used in electronic devices and high-temperature resistant tools. Cellulose , an organic compound derived from plants, is used in biodegradable plastics. Point 4 (Detection of Various Chemicals) Gitan 770 is a chemical used in production processes. EFKA 3236 is an additive used to improve the properties of rubber. Guar , an extract from the guar plant, is used in the food and cosmetics industries. Florisil is used in chemical separation processes in chromatography. Methylthiophosphonic Dichloride is used in chemical and pesticide production. Point 5 (Detection of Other Compounds) Bentonite Sample B  is a type of clay used in industries such as oil drilling. Ferric Hydroxide is used in wastewater treatment processes. Tetraallylsilane is a silicone compound used in the chemical industry. Other chemicals detected include 5-Chloro-2 (Trichloromethyl)Benzimidazole and Silicone Oil, High Temperature , which are used in industrial production and high-temperature resistant machinery.

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