Princess Chulabhorn Science High School Trang
Thailand

Study of Microplastics Contamination in Water and White Shrimp*(Litopenaeus vannamei)* from Shrimp Farming in Ranode District, Songkhla Province.

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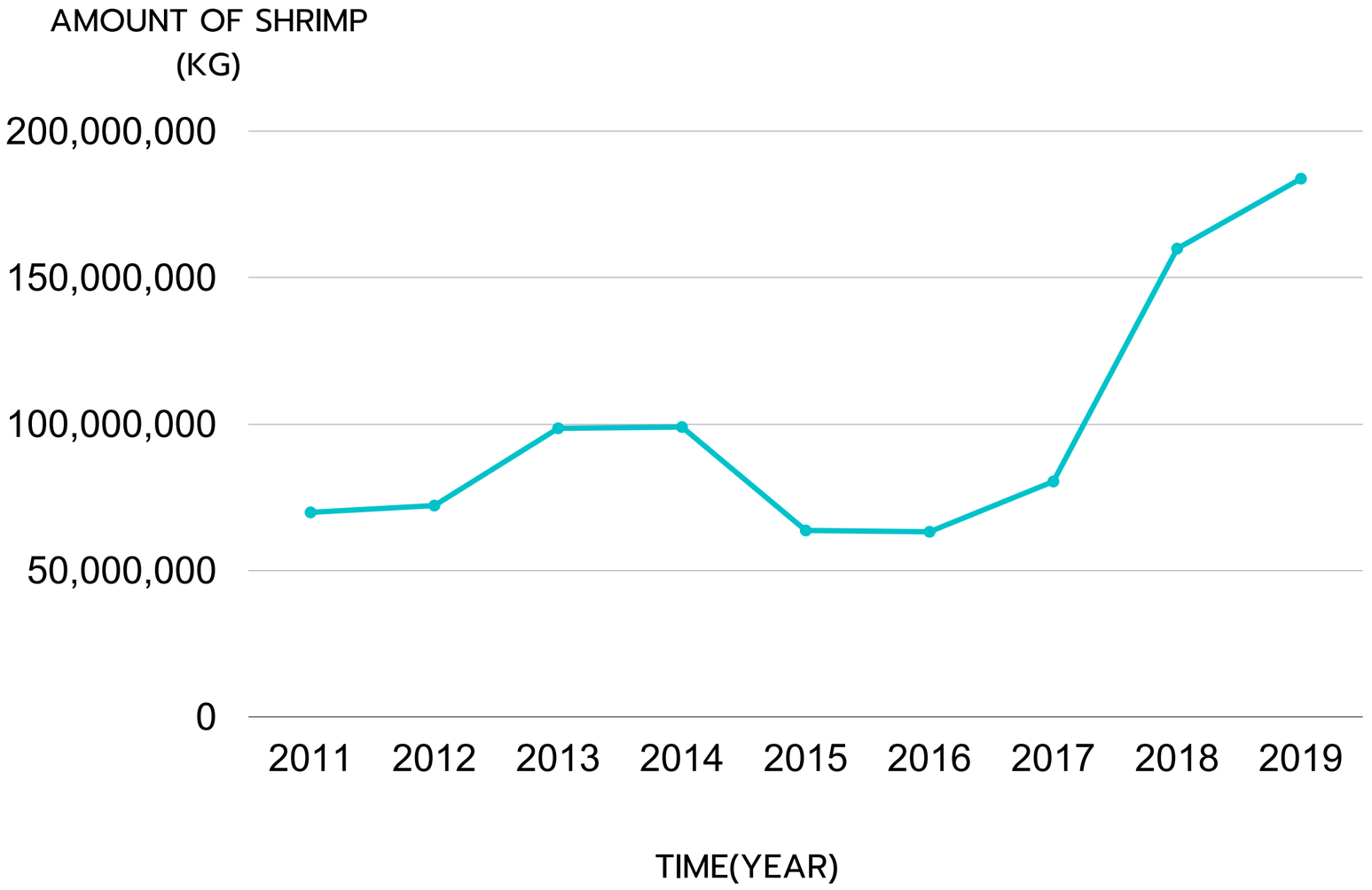
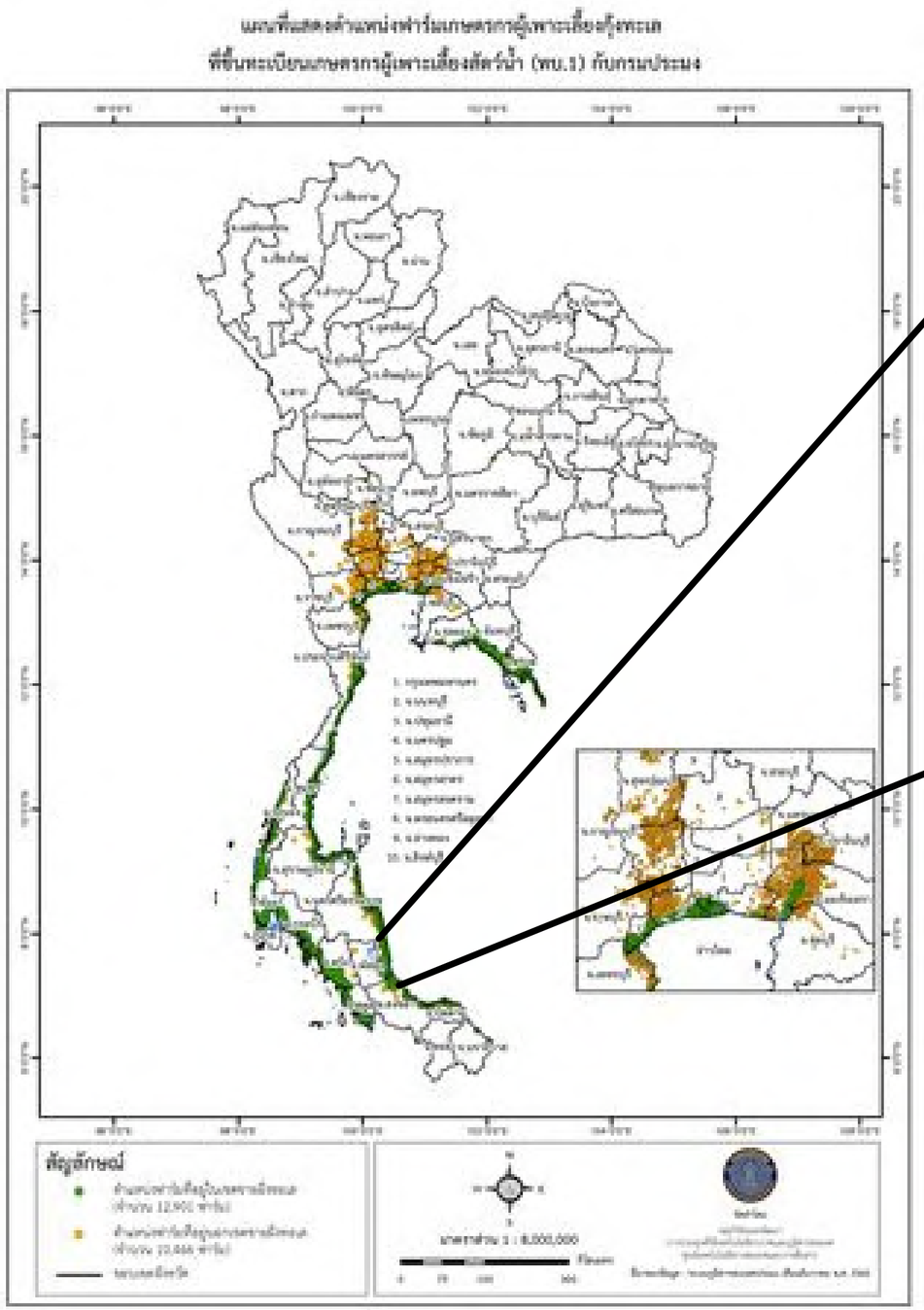


INTRODUCTION

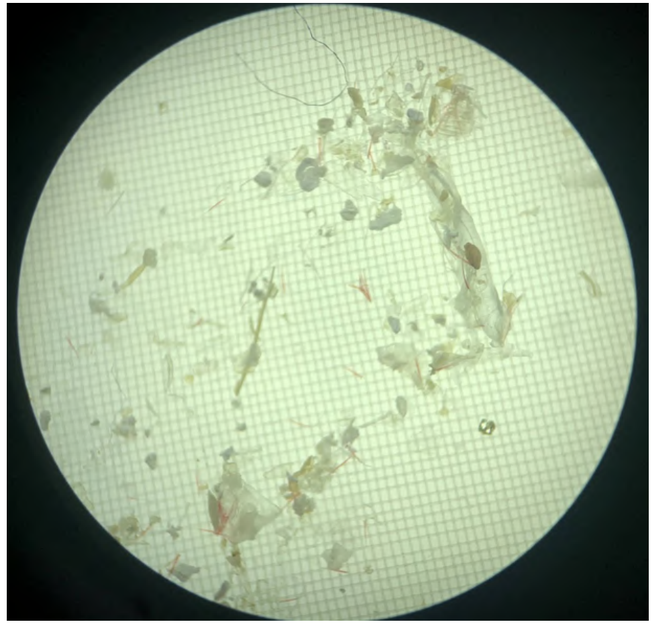
Export Data

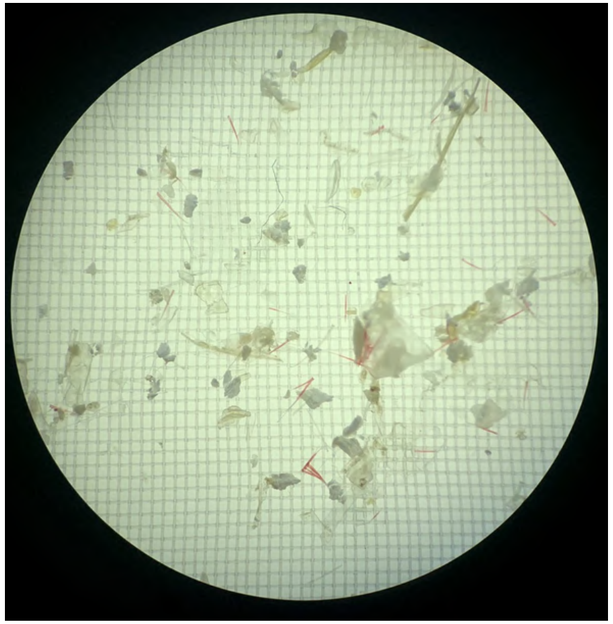
of *L. vannamei*
from Fisheries Development
Policy and Planning Division.

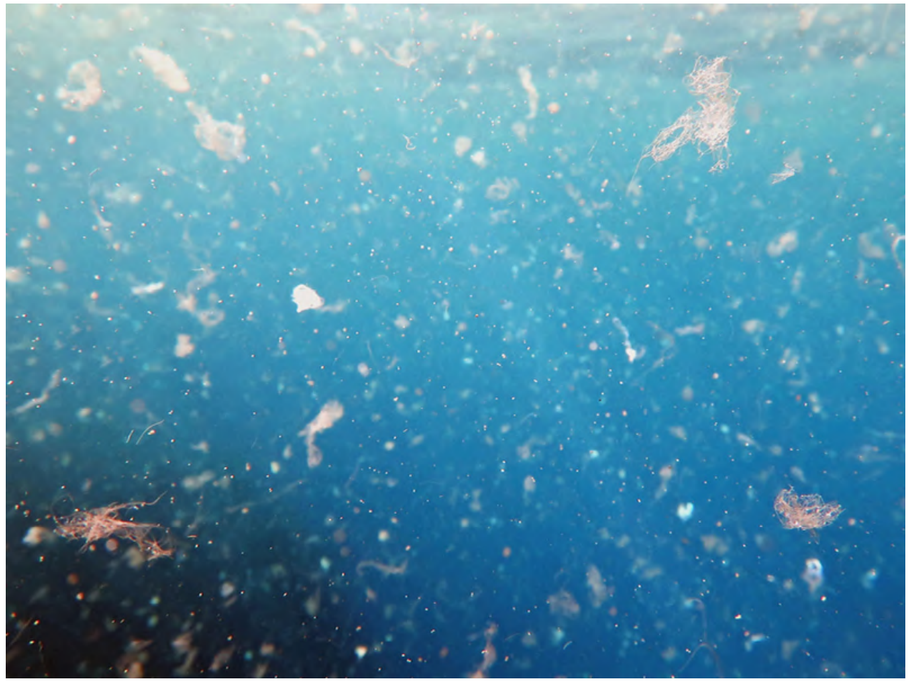


Shrimp Farming in Thailand

of *L. vannamei*
from Fisheries Development Policy and Planning Division.







Microplastics

Objectives

1. To investigate the number of microplastic presence in water and white shrimp (*L. vannamei*) in shrimp ponds in Songkhla Province, Thailand.

2. To investigate the microplastic numbers, size, shape and color in water and white shrimp (*L. vannamei*) in shrimp ponds in Songkhla Province, Thailand.

Hypothesis

" There are microplastics contamination in water and white shrimp in shrimp ponds "

Experimental design

1

collected sample

2

prepare the sample

3

remove the influence of the organic matter

4

filtered

5

dried at 60˚C for 24 hours

6

verify their chemical structure by using FTIR

STEP 1

1.collected the water sample
- preparation pond
- shrimp pond
- treatment pond

STEP 2

2.collected the shrimps sample.

STEP 2

prepare the shrimps sample.

Experimental design

1

collected sample

2

prepare the sample

3

remove the influence of the organic matter

4

filtered

5

dried at 60˚C for 24 hours

6

verify their chemical structure by using FTIR

STEP 3

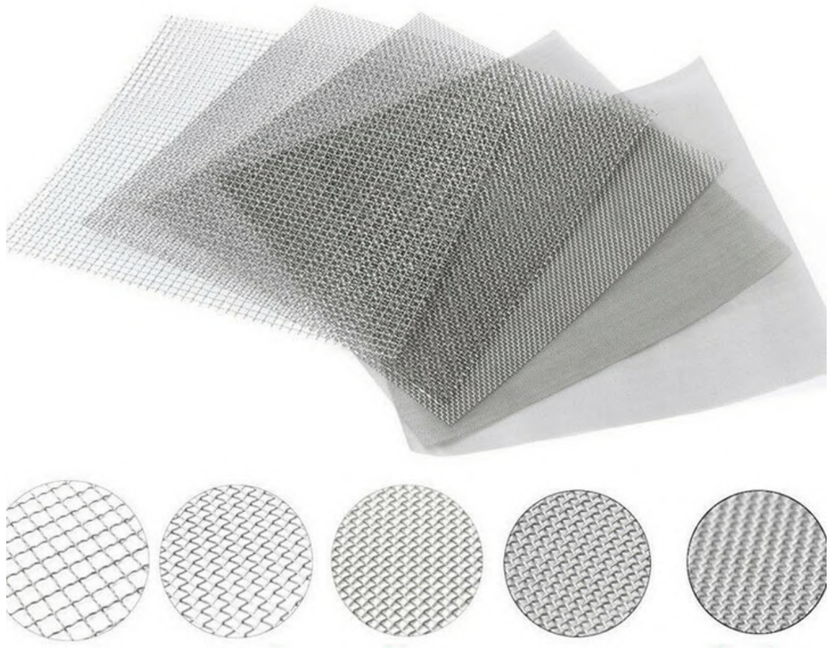
remove the influence of the organic matter .






STEP 4

flitered



STEP 5

dried at 60˚C for 24 hours.

STEP 6

verify their chemical structure by using FT-IR

WATER QUALITY TEST

We test water quality from 3 ponds, preparation pond, shrimp pond and treatment pond, by using GLOBE Hydrology protocol. Water indexes are pH, temperature, salinity, and dissolve oxygen. After that submit data to GLOBE date entry.

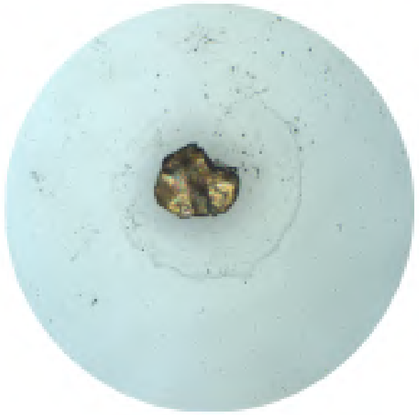
Result

Characteristic microplastic

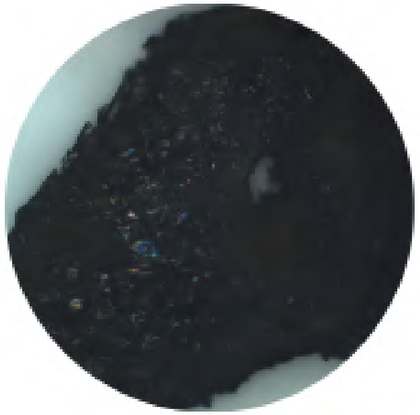
Black Fibers

Red Fibers

Blue Fibers



Yellow Fragments



White Fragments

Result

Water Experiment Results

Result

Numbers of Different-Sizes Microplastic found in Water from each ponds

Sites	Microplastic numbers / 1000ml water			
	<300μm	300μm-1mm	>1mm	total
treatment ponds	5±0.707	23±0.707	0	28±1.41
shrimp ponds	7±2.121	19±0.707	0	26±2.82
preparation ponds	5±2.121	8±1.41	0	13±3.53

Result

Numbers of Different-Sizes Microplastic found in Water from each ponds

Sites	Microplastic numbers / 1000ml water			
	<300μm	300μm-1mm	>1mm	total
treatment ponds	5±0.707	23±0.707	0	28±1.41
shrimp ponds	7±2.121	19±0.707	0	26±2.82
preparation ponds	5±2.121	8±1.41	0	13±3.53

Result

Numbers of Different-Shapes Microplastic found in Water from each ponds

Sites	Microplastic numbers/ 1000m^3 water	
	Fragment	Fiber
treatment ponds	19 ±0.707	9± 0.707
shrimp ponds	15 ± 4.94	11 ± 2.121
preparation ponds	12 ± 1.29	1 ± 0.707

Result

Numbers of Different-Colors Microplastics found in Water from each ponds

Sites	Microplastic numbers/ 1000m^3 water				
	White	Yellow	Black	Blue	Red
treatment ponds	17.00±2.121	3.00 ±2.121	1.00±2.121	4.00±2.828	3.00 ±2.121
shrimp ponds	10.50 ±0.707	0	0	3.00±2.121	2.00±1.414
preparation ponds	12.00 ±4.242	0	0	0	1.00±0.707

Result

Numbers of Different-Types Microplastics found in Water from each ponds

Sites	Microplastic numbers / 1000ml water		
	Polystyrene(PS)	Polypropylene (PP)	Polyethylene (PE)
treatment ponds	17.00±2.121	3.00±2.121	8.00±0
shrimp ponds	21.00±0.707	0	5.00±3.535
preparation ponds	12.00±4.242	0	1.00±0.707

Result

Shrimp Sample Experiment Results

Result

Numbers of Different-Sizes Microplastics found in Shrimp Samples

Sites	Microplastic numbers / 1kg shrimp		
	<300μm	300μm-1mm	>1mm
White shrimps (*L.vanami*)	189.00±37.476	502.00±19.798	179.00±45.961

Result

Numbers of Different-Shapes Microplastics found in Shrimp Samples

Sites	Microplastic numbers/ 1kg shrimp	
	Fragment	Fiber
White shrimps (*L. vanami*)	760.00 ± 108.894	109.00 ±6.363

Result

Numbers of Different-Colors Microplastics found in Shrimp Samples

Sites	Microplastic numbers/ 1kg shrimp				
	White	Yellow	Black	Blue	Red
White shrimps (*L. vanami*)	672.00±96.166	88.00±12.727	19.00±0.707	40.00±1.414	50.00±8.485

Result

Numbers of Different-Types Microplastics found in Shrimp Samples from each ponds

Sites	Microplastic numbers / 1kg shrimp		
	Polystyrene(PS)	Polypropylene (PP)	Polyethylene (PE)
White shrimps (*L. vanami*)	672.00±96.166	78.00±19.798	109.00±6.363

Result

Water Quality

Sites	Water quality		
	pH	salinity (ppt)	Dissolved Oxygen (mL/L)
treatment ponds	7.6±0.52	1.8±3.60	1.5±2.88
shrimp ponds	7.7±0.37	2.1±3.05	2.4±1.55
preparation ponds	7.0±0.76	1.8±4.58	0.6±0.35

Discussion

Thus, it is assumed that microplastics found in water and white shrimp can be classified in two categories according to their source. Polyethylene(PE) plastic comes from tools that used in shrimp ponds. Polystyrene(PS) and polypropylene(PP) plastics, which are plastics found in everyday items are contaminated in the seawater even before the preparation process.

The microplastic contamination in the water can affect the physiology of the white shrimp. Microplastics are small enough for them to eat but they can not be digested so they're remained in their body and made shrimps sick and lead to their death.

Discussion

The impact of such microplastic contamination will have a huge impact on the white shrimp farming business because of less efficiency of the white shrimp manufacturer. This leads to a serious loss of economic benefits to Thailand. Therefore, microplastic contamination is a problem that should not be overlooked and should be studied and find a solution as soon as possible.

Conclusion

The results showed that the water treatment ponds have the highest number of microplastics. The average amount of microplastics found in shrimp was 435 pcs/kg. Most of the microplastics were found in water and shrimp's sizes are range from 300µm-1mm , fragment shape, and white color. The most common type of microplastic is polystyrene(PS).

We can conclude that in shrimp farming, there are microplastics contamination in both water and shrimp. The microplastics found may come from seawater used for shrimp farming or may be from materials used in shrimp ponds.

Acknowledgements

We thank Dr.Anantanit Chumsri from Rajamangala University of Technology Srivijaya Trang Campus for helping with experimental design, data analysis and manuscript preparation.We would like to thank Marine and Coastal Resources Research Center, Lower Gulf of Thailand and National Metal and Materials Technology Center for analytical laboratory. This work was supported by Princess Chulabhorn Science High School Trang.

References

[1] IMGUR.2018. Plastic Microbeads. (Online). Available : https://imgur.com/gallery/aSWGw [20 November 2019].

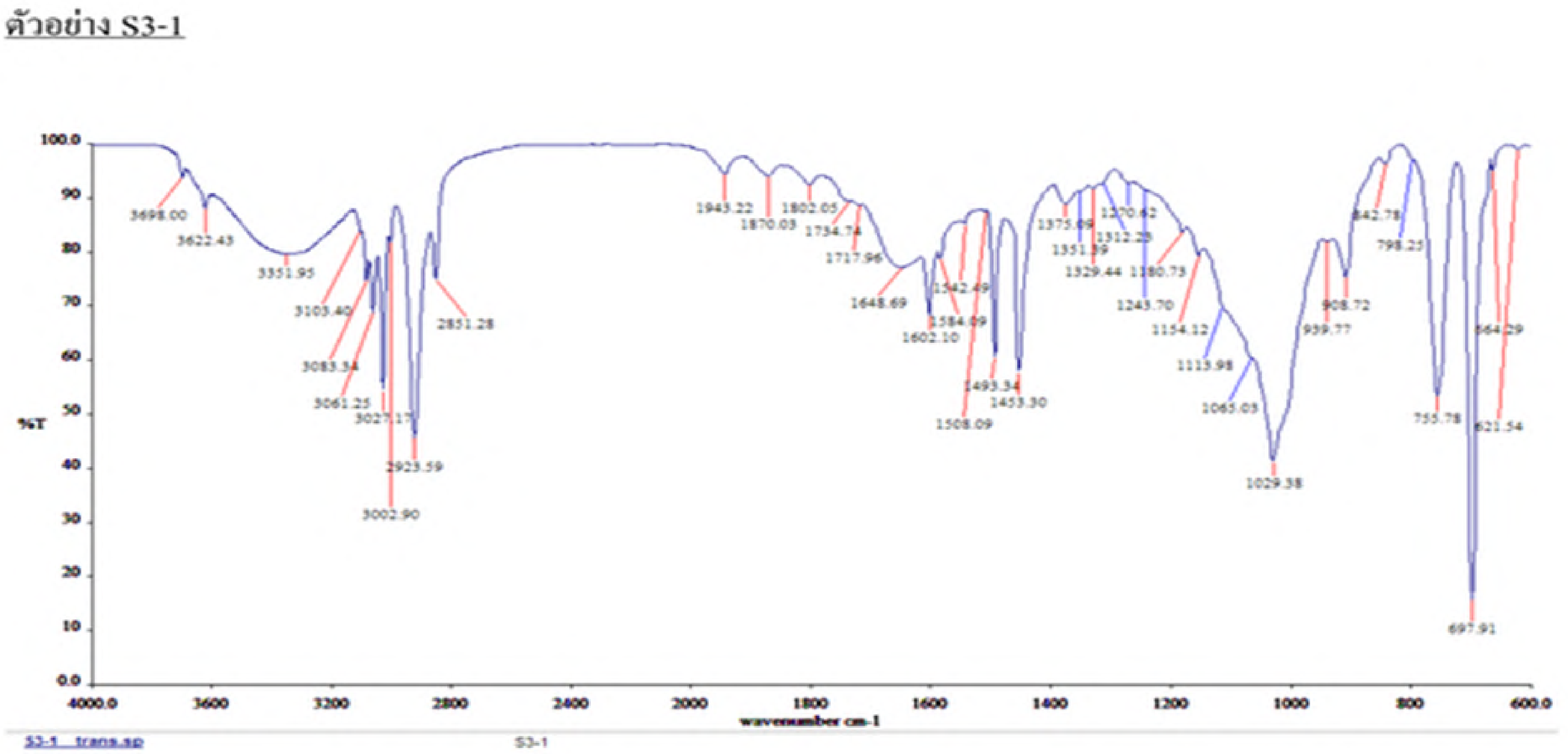
[2] Kara Lavender Law and Richard C. Thompson.2014. Microplastics in the seas. (Online). Available : https://science.sciencemag.org. [20 November 2019].

[3] Lisbeth Van Cauwenberghe and Ann Vanreusel.2013. Microplastic pollution in deep sea sediments. (Online). Available : https://www.sciencedirect.com. [22 November 2019].

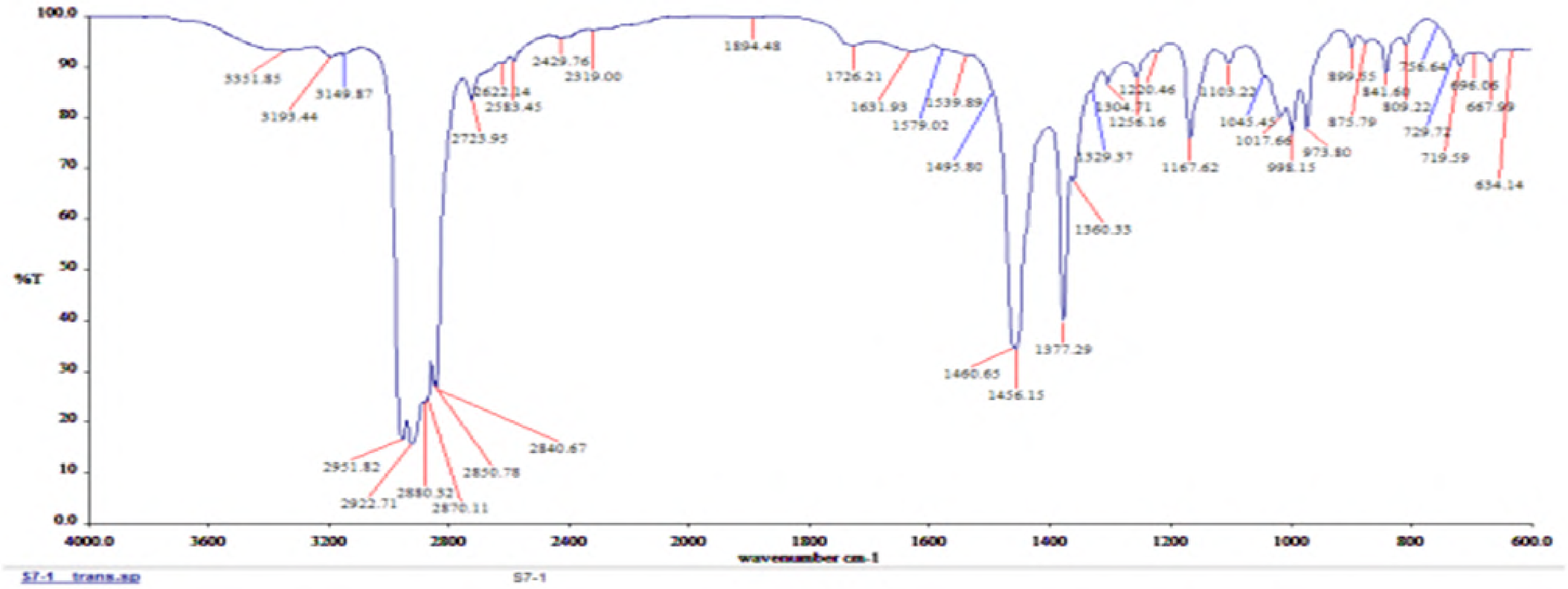
[4] Matthew Cole and Pennie Lindeque.2011. Microplastics as contaminants in the marine environment: A review. (Online). Available : https://science.sciencemag.org. [18 November 2019]

THANK YOU FOR ATTENTION

This graph show result from FT-IR Technique from sample S3-1 white color



This graph show result from FT-IR Technique from sample S7-1 yellow color



ตารางแสดงชนิดและองค์ประกอบหลักทางเคมีของตัวอย่าง **S3-1** ชิ้น สีขาว

ตารางที่ 27: แสดงแนวโน้มชนิดและองค์ประกอบหลักทางเคมีของตัวอย่าง S3-1

ตัวอย่าง	ชนิดและองค์ประกอบหลักทางเคมีที่สอดคล้อง
ตัวอย่าง S3-1	- สารประกอบประเภท polystyrene (PS)
	- สารเติมแต่งประเภท bituminous coal ผสมอยู่ปริมาณน้อย
	- สารเติมแต่งประเภท magnesium silicate (talc) ผสมอยู่ปริมาณน้อยมาก
	- สารประกอบในกลุ่ม ester compound ผสมอยู่ปริมาณน้อยมากๆ
	- สารประกอบในกลุ่ม unsaturated ester compound ผสมอยู่ปริมาณน้อยมากๆ

กตารางแสดงชนิดและองค์ประกอบหลักทางเคมีของตัวอย่าง ตัวอย่าง **S7-2**เส้น สีดำ

ตัวอย่าง	ชนิดและองค์ประกอบหลักทางเคมีที่สอดคล้อง
ตัวอย่าง S7-2	- สารประกอบในกลุ่ม polyethylene (PE)
	- สารประกอบประเภท polypropylene (PP) ผสมอยู่ปริมาณน้อยมาก
	- สารเติมแต่งประเภท magnesium silicate (talc) ผสมอยู่ปริมาณน้อยมาก
	- สารเติมแต่งประเภท silicon dioxide (SiO_2) ผสมอยู่ปริมาณน้อยมาก
	- สารประกอบในกลุ่ม unsaturated ester compound ผสมอยู่ปริมาณน้อยมาก
	- สารเติมแต่งประเภท calcium stearate ผสมอยู่ปริมาณน้อยมากๆ
	- สารประกอบในกลุ่ม aromatic compound ผสมอยู่ปริมาณน้อยมากๆ

ลำดับ	ความยาว (เซนติเมตร)	ความกว้าง (เซนติเมตร)	น้ำหนักกุ้ง	น้ำหนักฟอยด์	น้ำหนักฟอยด์และกุ้ง
.1.	15	2.0	13.5592	0.2955	13.8547
2.	13.7	2.0	9.4947	0.3271	9.8218
3.	13.8	1.7	10.2281	0.3244	10.5525
4.	14.5	1.8	11.4803	0.3211	1.8014
5.	14.7	2.0	12.3089	0.3244	12.6333
6.	14.2	1.9	12.3829	0.3261	12.7090
7.	14.5	2.3	11.2680	0.2885	11.5565
8.	14.4	1.5	10.8401	0.2562	11.0963
9.	14.5	2.2	13.8105	0.2504	14.0609
10.	13.7	1.8	10.3600	0.2902	10.6502
11.	13.6	1.7	10.0228	0.2562	10.2790
12.	14.3	1.6	9.6531	0.2492	9.9023
13.	13.8	1.5	8.2903	0.2409	8.5312
14.	13.5	1.7	10.3990	0.2727	10.6717
15.	14.0	1.9	11.1044	0.3058	11.4102
16.	13.2	1.6	8.7294	0.3229	9.0523
17.	13.4	1.7	11.1409	0.3004	10.4413
18.	14.9	1.4	8.7507	0.2928	9.0435
19.	14.0	2.2	13.7096	0.2451	13.9547
20.	13.4	2.2	11.6330	0.3152	11.9482
21.	14.0	1.7	9.2235	0.3252	9.5487
22.	13.4	1.7	10.6926	0.3233	11.0156
23.	15.0	1.5	11.3415	0.2947	12.6362
24.	14.9	1.5	8.5933	0.2850	8.8783
25.	14.0	1.7	10.7888	0.3097	11.0985
26	14.2	1.6	8.9951	0.3748	9.2699
27.	13.6	1.7	8.1696	0.3119	8.4815
28.	14.2	1.8	10.6672	0.3026	10.9698
29.	14.6	1.9	12.1020	0.2652	12.3672
30.	14.6	1.9	10.4170	0.2586	10.6856

ลำดับ	ความยาว (เซนติเมตร)	ความกว้าง (เซนติเมตร)	น้ำหนักกุ้ง	น้ำหนักฟอยด์	น้ำหนักฟอยด์และกุ้ง
.1.	11.7	1.7	8.0499	0.2955	8.3454
2.	12	1.8	9.3190	0.3271	9.6461
3.	11.4	1.7	9.1604	0.3244	9.4848
4.	11.5	1.7	9.1230	0.3211	9.4441
5.	11.0	1.7	7.5320	0.3244	7.8564
6.	11.4	1.8	8.1998	0.3261	8.9259
7.	11.0	1.8	6.9634	0.2885	7.2519
8.	11.3	1.7	7.7312	0.2562	7.9874
9.	11.0	1.9	7.6216	0.2504	7.8778
10.	11.5	1.9	8.1698	0.2902	8.4600
11.	11.9	1.7	7.8419	0.2562	8.0981
12.	11.4	1.5	8.3379	0.2492	8.5871
13.	11.1	1.4	7.2779	0.2409	7.5188
14.	11.2	1.4	6.2752	0.2727	6.5479
15.	11.0	1.5	7.5260	0.3058	7.8264
16.	12.0	1.7	9.2490	0.3229	9.5719
17.	11.5	1.6	8.9040	0.3004	9.2044
18.	11.6	1.8	8.6972	0.2928	8.9900
19.	11.3	1.5	7.1500	0.2451	7.3951
20.	11.8	1.6	8.9300	0.3152	9.2452
21.	11.8	1.6	8.5339	0.3252	8.8591
22.	11.7	1.6	8.4540	0.3233	8.7773
23.	11.9	1.6	8.4453	0.2947	8.7400
24.	11.9	1.5	9.5814	0.2850	9.8664
25.	12.1	1.9	8.8153	0.3097	9.1250
26	10.7	1.3	6.0607	0.2748	6.3355
27.	11.5	1.5	8.0926	0.3119	8.4045
28.	11.1	1.5	7.8270	0.3026	8.1296
29.	11.6	1.2	8.8965	0.2656	9.1121
30.	12.4	1.7	8.7804	0.2086	9.0490