The experiment of plastic reduce, reuse and recycle: exploring the 3R methods from a high school student's perspective

Ehime University Senior High School

Introduction

Plastic waste poses a significant problem for the environment and ecosystems.

This is primarily due to its harmful impact on marine life and ecosystems. It is needed to mitigate any adverse effects.

To address this problem, we conducted two experimental studies and one action research structured on the 3R sustainability concept of recycling materials, reusing items, and reducing consumption to solve the problems on plastics.

Conclusion

From a high school student's perspective:

1. Reusing plastic waste is not feasible
   -no practical ways, no equipment for the experiment at home
2. Recycling plastic waste is challenging
   -high cost for the chemical ingredients and time consuming
3. Reducing plastic waste is achievable
   -awareness can lead reducing waste and change people's behavior

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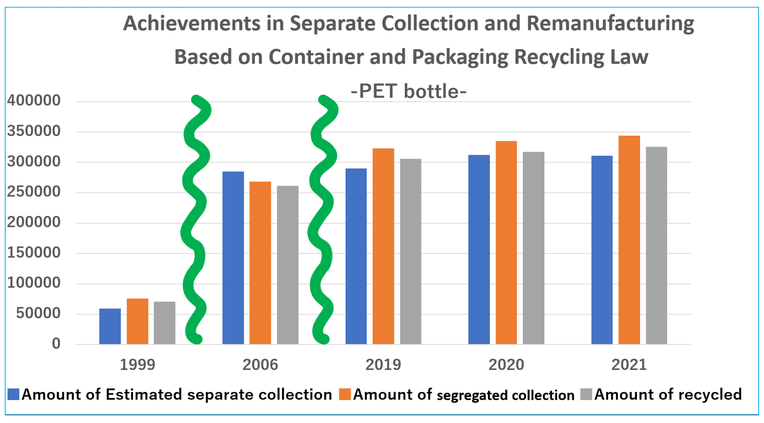
The priority of each concepts in the 3Rs is as follow...

Reduce>Recycle>Reuse

Background Problems

Problem①

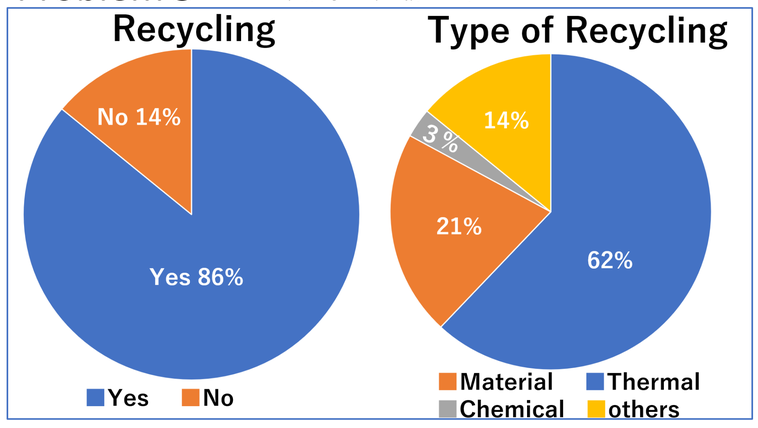
環境省_令和5年版　環境・循環型社会・生物多様性白書（PDF版）
https://www.env.go.jp/policy/hakusyo/r05/pdf.html



The introduction of paid bags in 2020 didn't lead to a reduction in the amount of waste.

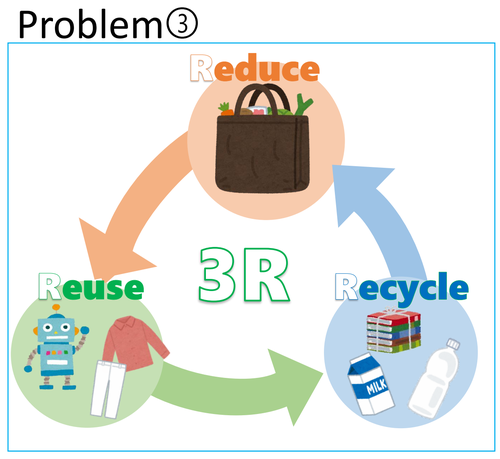
Problem②

廃プラスチック問題とは？世界と日本の現状・解決策 | SDGsコンパス
https://sdgs-compass.jp/column/1230



The rate of material recycle is no more than 21% In the all types of recycling.

Problem③



The quality is not equal for all three concepts for high school students.

Q1 : Is it possible to make a concrete block with plastic bottles? (Reuse)

Objective: To determine the practicality of concrete made by plastic bottles instead of gravel

Methods:

①Prepare ingredients: cement, water, sand, gravel and chopped plastic bottles


cement


water


sand

+


gravel

or


Plastic bottles

②Make two conclete blocks, each contain gravel and chopped plastic bottles

③break the concrete blocks to measure its strength

Result:

The one Including gravel _ *31.2N/mm²*

The one Including plastic bottles _ *2.5N/mm²*

Weak!


Broken bock including plastic bottles

Answer: No/Yes

It is possible to made the concrete block with plasstic bottles.
However, it is fragile and impractical.
Besides, it required technical equipment and considrable time.

Q2 : Is it possible to make an eraser with plastic wrap? (Recycle)

Objective: To determine the erasability of the eraser made from plastic wrap comparing with MONO eraser.

Methods: Create 10 kinds of erasers with different ingredients

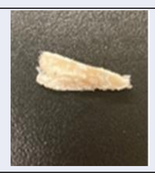
①Cut plastic wrap into small pieces.

②Add chemicals to ①. e.g. Bis(n-octyl) phthalate, calcium carbonate, limonene

③Heat in thermostat for 15 minutes.

④Chill in cold water for 5 minutes.

Result:

Ingredients	MONO eraser	A	B	C	～
Image					～
Elasticity	◎	◎	○	△	～
Erasability	◎	◎	○	×	～

Answer: No/Yes

It is possible to create an eraser with plastic wrap.
However, the process is time consuming and chemicals are expensive.

In conclusion of Q1,2...

Both Reusing and Recycling plastic waste are impossible because of ...

・no practicability ・no equipment ・no time ・cost

Q3 : Can people's awareness reduce the amount of waste? (Reduce)

Objective : To assess and reduce the quantity of waste generated within the school environment.

Methods :

It focused on communicating two key directives to students regarding the disposal of PET bottle.

①Encouraging efforts to minimize the generation of PET bottle waste.

②Promoting the practice of washing and sorting PET bottles before disposal.

Result : 87% reduction


Before


After

Answer: Yes

It can reduce the amount of waste.
It can change people's behavior.

Event : "Spo-gomi Koushien"

It is a national competition judged by how much waste you can pick up on the beach.

2021 : One team became a national champion

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2023 : 13 teams participated in the competition

The number of participants from our school has been increasing year by year.

The reason why H.S.Students could reduce their waste.

High school student study about SDGs.
By studying SDGs, the environmental awareness is increasing.

Not generating any money
In many cases, fulfillment and future goals motivate students.

Easy to work with the team
As a result, it becomes easier to take action.

⬇

H.S.Students should take an action by reducing.