### [cIRcLE] (23.Glow Of Diamonds)

### **Background Information**

The production of plastic from petroleum produces carbon dioxide due to the combustion of fossil fuels. In 2015, carbon dioxide emissions from plastic production were about 720 million metric tons. This is estimated to be about 2.8 billion metric tons by 2050 [1].

In order to reduce the large amount of carbon dioxide emissions from plastic production, we propose a device called *cIRcLE*. This device synthesizes biodegradable plastic from sunlight, water, and carbon dioxide.

Although there are already businesses that produce materials for plastic through artificial photosynthesis, plastic causes negative impacts on the environment. Specifically, they emit carbon dioxide when burned for disposal, and microplastic pollute the ocean. Even biodegradable plastic decomposes into water and carbon dioxide, so when produced using petrochemicals, they result in the release of fossil fuel-derived carbon dioxide into the atmosphere.

In *cIRcLE*, carbon neutrality is achieved by using carbon dioxide as an ingredient.

## <u>Outline</u>

In *cIRcLE*, hydrogen is first extracted from water, and this hydrogen and carbon dioxide are used to make lactic acid. Then, polylactic acid, a biodegradable plastic, is produced from the lactic acid. In the reaction to extract hydrogen from water, titanium dioxide, a photocatalyst that exhibits catalytic activity when exposed to ultraviolet light, is used. The ultraviolet rays used here are mainly from sunlight. With current technology, the efficiency of converting solar energy has reached 7.2%[2]. This is more than 30 times higher than the efficiency of plants, which is 0.2%[3]. On cloudy or rainy days, an ultraviolet irradiation system is used.

Hydrogen bacteria then absorb the extracted hydrogen and carbon dioxide from the air to produce lactic acid through carbon assimilation. By thermal decomposition, this lactic acid is synthesized into polylactic acid, which is then sold as biodegradable plastic.



# **Marketability**

### a.Target Analysis

We sell biodegradable plastic produced by *clRcLE* to plastic processing plants. Factories benefit from the stable availability of materials since they no longer need to import ingredients such as petroleum. In addition, the biodegradable plastic *clRcLE* produces can be offered at \$3/kg, which is significantly lower than the conventional \$7~10/kg[4]. This will also make the price of products manufactured at the plant cheaper than the usual biodegradable plastic products, increasing product purchases, and the plant's profits.

#### b.Marketing Strategy

We will provide brochures to companies to explain that our biodegradable plastic is environmentally friendly and does not cost that much. We will also introduce *cIRcLE* at tech conventions to raise awareness and increase the number of companies purchasing our plastic.

#### **Financial Projection**

(All amounts in US \$)	Year1	Year2	Year3	Year4
1.Revenues(a)	150,000	300,000	600,000	1,200,000
Price Per Ton	3,000	3,000	3,000	3,000
Amount of Products Sold (ton)	50	100	200	400
2.Production Cost(b)	201,500	0	0	0
Machinery Cost	200,000	0	0	0
Photocatalyst Cost	500	0	0	0
Hydrogen Bacteria Cost	500	0	0	0
UV-LED Cost	500	0	0	0
3.Expenses(c)	605,000	130,000	130,000	130,000
Rent	150,000	150,000	150,000	150,000
Staff Salaries	90,000	90,000	90,000	90,000
Development Cost	500,000	0	0	0
Maintenance Cost	0	10,000	10,000	10,000
Sales & Marketing	15,000	30,000	30,000	30,000
4.Profit / Loss Before Tax(d=a-b-c)	-656,500	170,000	470,000	1,070,000
5.Income Tax(e)	0	51,000	141,000	321,000
6.Net Profit/Loss(f=d-e)=Fresh Cash Flow	-656,500	119,000	329,000	749,000
7.Funding Required(g)	20,000	0	0	0
8.Loan Required(h)	100,000	0	0	0
9.Government Subvention(i)	50,000	0	0	0
10.Repayment of Loan(j)	0	25,000	25,000	25,000
11.Divident for Shareholders(k)	0	5,000	5,000	5,000
12.Cash Balance(I=f+g+h+i-j-k)	-486,500	89,000	299,000	719,000

Because *cIRcLE* uses advanced science and technology, we will put \$500,000 into its development. In addition, we will obtain government subsidies[5] to reduce the initial investment. Since the photocatalyst is a catalyst, there is no need to purchase it every year. Similarly, hydrogen bacteria grow fast, with one individual multiplying to 16 million in 24 hours[6], so only the initial cost is required. Due to *cIRcLE* being an unprecedented product, there is no clear production cost, but according to our calculations it will be profitable from year 2 and we will be able to distribute dividends.

### **Conclusion**

*cIRcLE* applies current technology to the sustainable production of biodegradable plastic. Here, the carbon dioxide released during decomposition is again absorbed by hydrogen bacteria to produce new biodegradable plastic. This is a breakthrough technology for decarbonization. To improve their corporate image by expressing their efforts to achieve the SDGs, companies will purchase our plastic more. This will allow us to have stable profits.

#### **References**

[1]https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf

[2]https://www.tytlabs.com/presentation/case-1.html

[3]https://www.shimadzu.co.jp/boomerang/44/04.html

[4]https://www.sanko-shoji.jp/lecture/cn4/pg128346.html

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