

Fuzzy Logic Based Polymer Waste Management

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Abstract-This paper is about the polymer management by using the fuzzy based logic controllers. By analyzing the various levels of uncertainty in the solid waste management of polymers, the rule base of the Fuzzy controller is used. Since the use of plastics has increased considerably in the day to day activity, the efficient management of the plastic is necessary for disposal and recycling of the polymers according to the type of micron size of the plastic. For develop the Fuzzy logic controller for the plastic management, the data has to be collected and analyzed for different area and different number of size of the population. By giving the parameters has to be considered for the polymer management, the respective membership functions are formulated and the rule base is fixed for those membership functions. Usually more degree of membership functions are taken for the accurate results.

Keywords-Fuzzy, polymer, membership function.

I. INTRODUCTION

Engineering is a tool for the management of various problems by solving it with more accuracy. Here the polymer waste management is done for the effective use of the product and with a goal of zero waste by recycling and converting the waste product in to subsequent useful product.

Here, in this paper it is focused on the efficient management of the polymer waste management by using the fuzzy logic controller based approach. The membership functions are taken and the parameters which has to be considered for the efficient management of the waste polymer disposal is chosen as rule base.

Usually in taking decision for the problem there will be three classifications as uncertain, certain and risky. This Fuzzy logic controller will take the accurate decision for the management of the polymer waste. The steps involved in Fuzzy controller Is Fuzzification, application of fuzzy operators, fuzzy implication, fuzzy aggregation, defuzzification.

A. FUZZY OPERATION

Fuzzy logic for the polymer waste is more applicable because of the quantitative approach of the given problem and it will provide best decision according to the rule base given to the Fuzzy controller. Since decision is unpredictable, Fuzzy controller will give accurate results.

B. FUZZY SET .

The main purpose of the Fuzzy set is to denote the amount of interference of the value to the particular set value. But

where as in normal set only the presence of the value to the particular set can be seen. This is advantage of the fuzzy based controller for accurate output.

II. POLYMER WASTE MANAGEMENT

For the polymer waste management using Fuzzy, the inputs are needed for the reference value. In this paper, the reference are taken from the economic times for the amount of the polythene usage by various countries. China is one of the largest usage of plastic and India is in twelfth position which produces 3% of plastic waste.

Even though India produces 3% of plastic waste, the mismanaged plastic waste is about 1.9% of the total value. The mismanagement waste of polymer by china is about 87% which is less than India. From the statistics report of the economic times Delhi produces 40% more waste than Mumbai. India tried to reuse the polymer waste by recycling of about 60% of the total polymer waste produced. In this paper, the reference values are taken for the simulation of the Fuzzy logic based polymer waste management. The mismanaged waste of United States is about 2% and mismanaged polymer waste is only 0.9%. By seeing this statistical review of various countries, the polymer waste management is necessary for maintaining the global hygiene and welfare. And another statistical report shows that 6.9% of global economy is based on the waste management.

III. MEMBERSHIP FUNCTION

In this paper ,the linguistic variable 'C' is taken as the cost for the clearing and recycling of the polymer. There are three linguistic variables are taken and three membership functions are taken. They are

- C= Cost management of the polymer disposal (Low, Medium ,High)
- I=Adverse impacts on the environment(Low, Medium, High)
- T= Technical feasibility (Low, Medium, High)

A. ALTERNATIVES

The alternatives for the recycling of the polymer waste management is taken as

- i) Using the polymer waste for the laying roads which was approved by the government by reducing the cost of the tar **A1**

- ii) Converting the polymer waste into useful products like carpets, bags , **A2**
- iii) Simply dumping the polymer in the land fill or disposing the plastic **A3**
- iv) Using Fuel oil after doing the process called plastic pyrolysis and using for boiler operation **A4**

B. BLOCK DIAGRAM

The block diagram of the proposed work is shown below. The input is given to the fuzzy and the alternatives are taken as output. The rule base is given to the Fuzzy controller for the proper decision making process of the given input.

The Fuzzy rule base will change according to the location of the use. If the geographical location is taken as industrial there will be more High density polyethylene and if it is commercial buildings, there will be more Low Density Polymers because of the use of tin, can and plastic covers.

According to it, the rule base will change and it has to be updated by the user by verifying the statistics of polymer waste disposal. But every year there is increase in the polymer disposal of the country by using modern technology for the disposal of the polymer waste.

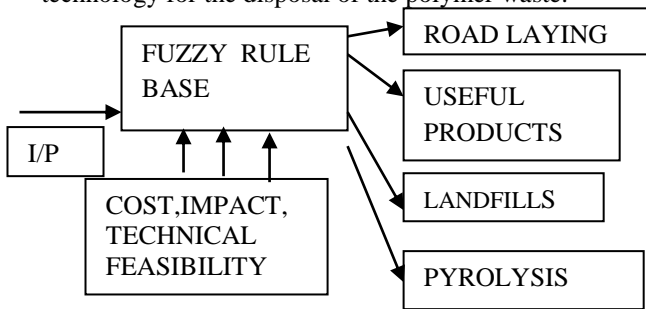


Figure 1 : polymer waste management

IV. SIMULATION RESULTS

The simulation is done using Matlab using fuzzy logic tool. For the evaluation of input, fuzeval command is used. By giving the input , the output is displaced in the matlab screen. In this paper mamdani fuzzy model is used where the other fuzzy models are Sugeno, and Tsukamoto.



Figure 2: Simulation block diagram using Mamdani

There are three membership functions are taken as low, medium and high and four alternative solutions are taken for the polymer waste management using Fuzzy logic based approach. The simulation results of the above are shown in the figure.

The reason for choosing the Mamdani Fuzzy model is due to the fact that it will provide accurate results for the human based input when compared to the other Fuzzy model based approach.

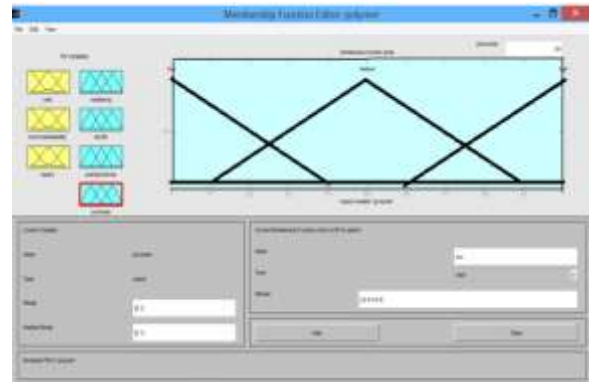


Figure 3: Membership Function

A. RULE BASE FOR FUZZY CONTROLLER

The rule base for the fuzzy controller is given by the user according to the constraint which was taken. In this paper, there are about fifteen rules are used for the evaluation of the fuzzy for the polymer waste management. The rule base will differ from one user to other and it is applicable to various geographical applications like residential, commercial etc.,

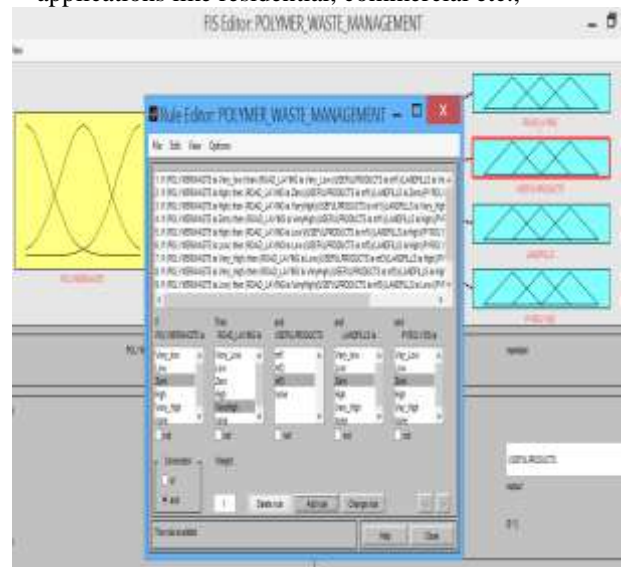


Figure 4: Rule base of polymer waste management

In the rule base of the Fuzzy controller, the rules are formulated to find the correct alternative of the waste polymer disposal by different linguistic variables like cost, technical feasibility and due to the alternative what are the environmental impacts.

V. TABULATION AND RESULTS

These are the results for the polymer waste management. From this table we can infer that only if the cost is more, the first alternative is possible and if technology is less the third alternative is possible.

	Cost			Tech			Impact		
	L	M	H	L	M	H	L	M	H
A1	0	0.2	1	0.2	0.5	1	1	0.5	0.2
A2	0.5	0.8	0.5	0.8	1	0.5	0.2	0.8	1
A3	0.8	1	0.2	1	1	0.2	0.5	0.2	0.8
A4	0.2	0.5	0.8	0.5	0.8	0.8	0.8	1	0.5

VI. CONCLUSION AND FUTURE SCOPE

This paper is useful for the effective management and disposal of the polymer waste by Fuzzy logic controller. The fuzzy algorithm believes in assisting the decision making and in quality output report conditions which even investigates the temporary change that take place in the waste management. The algorithm tool and concept if used logically, could be more helpful and successful tool. for. some. of. the. environmental. policy. matters. Fuzzy algorithm model. based. on. FIS. can. be. used. for. future. determination. of polymer waste management for different parameters. More severe methods are used to begin the ideas of the algorithm that can be applied on the Fuzzy algorithm model. This work can be extended by using the image processing technique for analyzing the different wastes like cans, water bottles, bags from the bio degradable waste and it can be eliminated by artificial intelligence based approach of using neural network.

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