OPTIMIZATION OF WASTE DISPOSAL METHOD IN URBAN FUNCTIONAL ZONE BASED ON MULTIPLE MODEL EVALUATION: A CASE STUDY OF AN URBAN SUB-DOMAIN PLANNING

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With the implements of urban and rural areas integration planning and new rural countryside construction, a new town planning is springing up in China. Planning of municipal solid waste (MSW) disposal is one of the most important contents. In the new town planning, MSW is considered as one kind of energy source instead of a trash stream, so how to choose a suitable method of waste to energy (WtE) and analyze the feasibility of the method combined with urban functional zone need to be considered. In this paper, by adopting the analytical hierarchy process (AHP) method which consists of life cycle analysis (LCA) model, cost benefit analysis (CBA) and questionnaire survey, the environmental benefits, economic benefits and social benefits are considered to decide the best WtE route for MSW in an urban functional zone. The functional unit is selected to be 1 ton of waste, and the system boundaries include the process of collection and transportation, disposal, and utilization of generation and treatment of residue. The alternatives include central incineration, in situ pyrolysis, central incineration of combustible MSW+ in situ anaerobic digestion of organic waste and in situ pyrolysis of combustible MSW + in situ anaerobic digestion of organic waste. The 4 alternatives are evaluated to determine the best suitable disposal method of MWS of a center business district (CBD) of a city in north China.

The area of the CBD is 3150m×2100m, the generation rate of MSW is about 78t/d, of which the proportion of food waste is 50.84%. For small and moderate scale, tubular reactor can be competitive, so tubular reactor is selected in this study. The technical routes of the 4 alternatives are as followed:

1. Collection (dry waste & wet waste) →transportation (78t/d) →central incineration (entire city: 836t/d) (energy generation efficiency: 25%; flue gas: purification; bottom ash: landfill; fly ash: solidification and landfill)

2. Collection (dry waste & wet waste)→pyrolysis in transfer station (78t/d) → pyrolysis gas into distributed energy station (pyrolysis gas: purification; residual char: landfill)

3. Collection (dry waste)→transportation(38.3t/d)→central incineration(entire city: 836t/d)
Collection(wet waste)→anaerobic digestion in transfer station(39.6t/d) →biogas into distributed energy station (biogas: purification; digestion residue: landfill)

4. Collection(dry waste)→pyrolysis in transfer station(38.3t/d)→pyrolysis gas into distributed energy station(pyrolysis gas: purification; residual char: landfill)
Collection(wet waste)→anaerobic digestion in the transfer stations (39.6t/d) →biogas to distributed energy station (biogas: purification; biogas residue: landfill)

The evaluation result shows that the alternative 4 is the most suitable disposal method in urban functional zone.