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Waste Free Srinagar City

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ABSTRACT

The paper deals with the concept of a clean Srinagar City. As the population of this city has grown in the recent years, and so has the waste generation. The waste is in the shape of solid waste and liquid waste, apart from generation of pollutants which have created problems in the atmosphere . Although liquid waste in the shape of sewage is being taken care of, yet no solution has been provided to deal with the solid waste. The municipal garbage bins are overflowing and the transportation , disposal and treatment are yet to be finalized. At present, the whole of solid waste is being dumped at the open dump site Achan. This has resulted in an unsanitary condition in the area, and the problem is increasing as the days pass by. A lot of untreated solid waste has accumulated at the site and a large quantity of leachate is polluting the ground water. A number of meetings with the local municipality have resulted in various solutions, but none has been finalized.

The paper presents the quantification , qualitative analysis and the most feasible treatment proposed for this problem.

KEY WORDS

Achan ,Solid Waste , Collection, Segregation, Treatment, Reclamation, Leachate, RDF

INTRODUCTION

Srinagar is the summer Capital of J & K state. The city is located on both the sides of the Jhelum River, which is called *Vyath* in Kashmir. The river passes through the city and meanders through the valley, moving onward and deepening in the Dal Lake. The city is famous for its nine old bridges, connecting the two parts of the city.

There are a number of lakes and swamps in and around the city. These include the Dal, , the Anchar, Khushal Sar, Gil Sar and Hokersar.

Srinagar has a humid subtropical climate. The valley is surrounded by the Himalayas on all sides. Winters are cool, with daytime temperature averaging to 2.5 °C (36.5 °F), and drops below freezing point at night. Moderate to heavy snowfall occurs in winter and the highway connecting Srinagar with the rest of India faces frequent blockades due to icy roads and avalanches. Summers are warm with a July daytime average of 24.1 °C (75.4 °F). The average annual rainfall is around 720 mm (28 in). Spring is the wettest season while autumn is the driest.

Srinagar is one of several places that have been called the "Venice of the East". It is also a world famous tourist destination. But in the recent years, due to increase in population, a lot of solid waste is being generated which has created a number of concerns. Firstly, the aesthetic look of the place has degraded, secondly the water bodies have a threat of extinction due to inflow of sewage and solid waste, especially non bio degradable materials like plastic and polythene. A plan has been proposed to bring back the lost glory by managing its solid waste.

WASTE QUANTIFICATION

The waste generated has increased due to increase in population and increase in per capita generation. The per capita generation recommended by IS 12647-1989 is 0.4 Kgs/Capita/Day whereas it is 0.2 to 0.5 Kgs/Capita/Day as per CPHEEO Manual. NEERI recommends it to be 0.1 to 0.6 Kgs/Capita/Day depending on the type of place, habits of people and life style.

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There is also a seasonal variation in solid waste quantity generated. The quantity is more during tourist season, marriage season, which is maximum in the months of September and October. More paper items are disposed in summer than in winter due to holidays and shifting of offices to winter capital Jammu. Keeping all these factors in to consideration and from observations, a value of 0.4Kgs/Capita/ Day seems appropriate.

The population of Srinagar city in 2017 as per estimated data = 1.576 Million.

Assuming a design period of 10 years, design population in 2027 =2.036 Million

Hence Solid Waste generation in design year=814 tons/day assuming 0.4 Kgs/Capita/Day

WASTE SOURCES

The major types of waste are house hold, Commercial waste, Bio Medical waste, Construction and Demolition waste, E Waste, Hazardous Waste, Fruit and vegetable Mandi Waste, recyclable Waste, Slaughter House Waste and other minor Wastes.

WASTE QUALITY

The Physiochemical analysis of the solid waste is being done in accordance with IS 10158 for various parameters like moisture content, pH value, Total Nitrogen(N), Total Phosphate, Potash, Total Solid, Organic Carbon, C/N Ratio, Gross calorific Value and Bulk Density. The results are envisaged to be almost the same as already done for the rest of kashmir valley. The values are given below:-

Table-1 Physio Chemical Characteristics of Solid Waste

Moisture Content	36.10%	Total Solid	24.84%
pH of 10% Solution	7.90	Organic Carbon	36.70%
Total Nitrogen (N)	1.33%	Carbon: Nitrogen Ratio (C : N)	27.59
Total Phosphates (P2O5)	0.40%	Gross Calorific Value Cal/gm	924
Potash (K2O)	0.63%	Bulk Density Kg/m3	409

COMMENTS ON THE DATA

The data regarding physio chemical parameters indicates a high moisture content. Thus waste to energy will not prove beneficial as a large amount of heat shall be required to first dry the waste and then recover energy from it. During winter season, the moisture content will be much higher. Also low temperature, especially sub zero, it will require more energy to dry than can be recovered from it. On the other hand, the calorific value of the mixed waste is low, hence heat recovery will be too low and not beneficial. Since the organic waste forms a high percentage, WTE is not advisable.

The Valley has a huge agricultural potential, and food grains are becoming rare due to rapid urbanization. It is advisable to produce a useful product out of the solid waste like compost. This compost can be used in the valley as well as sent out of the state for sale. Today, a huge stress is laid on organic fertilizer and artificial fertilizers have to be phased out.

USE OF HIGH CALORIFIC VALUE WASTE IN CEMENT PLANTS

In a number of deliberations with the local municipality, the high calorific value portion of the solid waste like plastic, cardboards, paper, wood chips etc. were proposed to be used as a fuel for the Cement plants of the valley. A meeting was held with the stake holders, in which they were told to consider this option. The fuel cost were envisaged to come down appreciably. The product referred to as RDF is being utilized in cement and power plants elsewhere. RDF normally has a calorific value of as high as 6000 Kcal/Kg.The required

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specific composition and characteristics of RDF for co processing will be determined by the kind of furnace, temperatures achieved in the furnace, and the associated flue gas management systems. For this purpose, modifications were proposed in the main furnace. Also, the conversion of solid waste to RDF would require a number of steps, as per solid waste management rules-2016 and CPHEEO Manual-2016.

COLLECTION AND TRANSPORTATION SYSTEM PROPOSED

The collection system shall start from the house holds, commercial establishments, markets, offices. The concept of door to door collection will prevail. Consumers will be given dust bins of various colours to carry out segregation at source in order to minimize treatment cost .This will be done by primary collection vehicles like auto rickshaws, hand carts etc. The secondary transportation will consist of bigger vehicles like tippers whereas the final transportation will comprise of big hydraulic compaction trucks. All solid waste shall be carried segregated in separate compartments to the final disposal site. The transportation vehicles shall be in accordance with IS:- 12662--part 1 & 2-Guidelines for use of Vehicles for Solid Waste Disposal, IS :- 16557--2016- S W Management : Segregation, Collection , Utilization, at house hold/ Community level guidelines and IS:- 12647- Solid Waste collection equipment guidelines.

FINAL DISPOSAL AND TREATMENT SITE---ACHAN

At present, the final disposal site is Achan. This site has become a major concern due to lack of treatment procedure, bad odours, unmanaged Leachate generation and public inconvenience. A lot of untreated solid waste has accumulated at the site.

The approximate area of the site is 0.27 km^2 . Although the site has been modified from time to time, yet it lacks the title of a scientific sanitary land fill. A lot of work needs to be done. Reportedly there is a leachate treatment plant, but the ever growing quantity of waste dump and leachate generation is becoming difficult to cope up with. The site needs immediate attention with a proper waste treatment plant, an RDF production plant and a leachate treatment plant.

COMPONENTS OF UPGRADATION

The site needs up gradation in terms of clearing the area required for the construction of waste treatment plant, RDF plant, Leachate treatment plant and sanitary land fill site.

(A) WASTE TREATMENT PLANT(WINDROW COMPOSTING)

The total solid waste is about 814 tons/day. A waste treatment plant would comprise of the following activities:-

Table-2 Steps of Process

Initial quantity Tons	Process to be carried out	Quantity separated or reduced Tons	Final Quantity Tons
814	Segregation by conveyor belt and by rotating cage of opening 75 - 100 mm (20% to RDF)+some inert material removal.	20%=163 (rounded off)	651
651	Windrow formation for 3 weeks, turning, loss of moisture and gas	35%=228	423
423	Monsoon/curing shed	20%=84	339
339	Trommel 35 mm (25% to RDF)	25%=85	254
254	Trommel 16 mm(20% to windrows cover)	20%=51	203
203	Curing and refinement 4mm screens(20% as windrows cover)	20%=41	162
162	Packing and storage(final Compost)	----------	162

Total compost production=162 Tons(about 20%)

Total to RDF production=163+85=248 tons(about 30%)

Out of this fraction, a limited quantity will actually be converted to RDF. The RDF fraction should have the following characteristics:-

DESIRABLE REFUSE DERIVED FUEL CHARACTERISTICS FOR Co-PROCESSING IN CEMENT PLANTS

- Moisture, preferably < 20%
- Size, 2D < 120 mm, 3D < 70 mm subject to process limitation of specific cement plant
- Chlorine, preferably < 0.7% depending on particular raw mix and fuel mix
- Calorific value, preferably > 3,000 kcal/kg
- Sulfur, < 2% depending on particular raw mix and fuel mix
- Free of restricted items (polyvinyl chloride, batteries, aerosol containers, biomedical waste)

(B) RDF PLANT

About 248 Tons per day of material **minus** the inert material like glass, metals, C&D will go for RDF production. About 10-15 % inert material will go to land fill. The given table indicates the

various processes of RDF Production:-

(1) Sorting or mechanical separation (in case of effectively source segregated feed material, this process may not be required);

(2) Size reduction (shredding, chipping, and milling);

(3) Drying (where required);

(4) Separation;

(5) Screening;

(6) Air density separation (for removing fine inert material);

(7) Blending;

(8) Packaging; and

(9) Storage in the shape of briquettes.

The RDF can be easily transported to the cement plants and can be stored for long periods. They are to be used after modifications in the cement Kilns.

Un processed RDF can also be used in the cement Kilns, but after appreciable modifications in the furnaces. This will also fetch revenue from the end users.

LEACHATE TREATMENT

The leachate generation will take place from windrows and from sanitary land fills. The concentration of leachate from the Windrows will be very high. Some chemical parameters of Leachate generated are given below:-

	Concentration (mg/L)		
Constituent	1 Year	5 Years	15 Years
BOD	20,000	2,000	50
TKN	2,000	400	70
Ammonia-N	1,500	350	60
Phosphorous	150	50	-

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LEACHATE TREATMENT METHODS:-

(A)Common Treatments.

- Anaerobic or Aerobic Biological Treatment
- Constructed Wetlands
- Physical & Chemical Treatment
- Leachate Recirculation
- Leachate Evaporation Technologies
- Additional Innovative Technologies

(B)Anaerobic Treatment

- SBR
- MLE
- Two-Stage Reactor
- Fixed Film Filters

(C) Aerobic Treatment (preferred)

- Lagoons
- Activated Sludge
- RBCs/Trickling Filters

SANITARY LAND FILLING

Sanitary land filling will involve the process of disposal of non bio degradable, non recyclable, inert material. However, due to efficiency problem in the treatment system, some bio degradable material finds its way in the land fill. Due to precipitation, the Leachate percolates in the ground and pollutes the ground water. To prevent this, ground preparation has to be done as per CPHEEO manual. A landfill can be both above ground or partially below ground, based on the local hydro-geological situation and the availability of land. Above ground landfills have the advantage that leachate flows by gravity. A grid of collecting pipes will be laid to drain out the Leachate. Below the grid, composite layers of HDPE and compacted soil will be placed.

If water table is not close to the ground surface, landfill base can be at a level below the ground, by excavation, to accommodate more waste per unit area of land. Ground water table has to be located before designing the land fill.

The concept of a bio reactor shall be also incorporated. Small amounts of Leachate shall be sprayed on the land fill.

ENVIRONMENTAL CONCERNS

The following points will have to be considered in the overall waste management of Srinagar City.

* Door to Door collection has to be done.
* Waste segregation at source has to be followed
* Transportation of Waste has to be done in separate compartments of the carrier.
* Covered transportation for odour and aesthetic protection.
* Ground water quality at Achan treatment site has to be monitored periodically
* Air pollution monitoring at treatment site has to be done.
* Sound pollution at treatment site has to be prevented
* A buffer zone has to be created round the treatment and dumping site by planting appropriate type of trees.
* All safety precautions to be followed

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CONCLUSION

Making a Waste free Srinagar city will result in the following benefits.

* The city will appear clean and will become a better place for the locals as well as the tourists.

* Proper waste management will prevent rodent breeding.

* The compost produced will enhance the soil quality for better crop growth and will also earn revenue by exporting it to other states.

* The RDF produced will act as an alternate fuel and save our natural resources.

* Pollution and choking of water bodies by solid waste, especially by polythene products will be prevented.

REFERENCES

(1) CPHEEO Municipal Solid Waste Manual-2016 Part-1 , Part-2 and part-3

(2) IS 12662--part 1 & 2-Guidelines for use of Vehicles for Solid Waste Disposal

(3) Manual on production, properties and uses of RDF-2016

(4) Manual on norms and standards for environment clearance of large construction projects--Ministry of Environment and forest

(5) IS 10477 - Guidelines for utilization and disposal of Solid Waste

(6) IS 9622-1980-Indian standard guidelines for management of SW

(7) IS 12647- Solid Waste collection equipment guidelines

(8) IS 16557--2016- S W Management : Segregation, Collection , Utilization, at house hold/ Community level guidelines

(9) IS 9533- Guidelines for Selection of Methods of Urban S W Disposal

(10) Solid Waste Management Rules-2016

(11) Plastic waste management Rules-2016

(12) C&D waste management Rules-2016

(13) Bio medical waste management rules-2016