

УДК 628.4

THE ENVIRONMENTAL BENEFITS OF SOLID WASTE RECYCLING IN SANA'A CITY (YEMEN)

N.S. Al-Ahwal

St. Petersburg State Polytechnical University, St. Petersburg

Represented by Doctor of Technical Sciences, Professor E.G. Semin

Key words and phrases: energy resources; glass; plastic; solid waste.

Abstracts: This article shows the results of the study of the morphological structure of solid waste in Sana'a city in Yemen and the current status of waste management in the city, taking into account the significant population growth in Yemen which comes in fifth place for the high fertility rate. The article demonstrates the advantages of separation of waste and recycling them to conserve both energy and resources, especially there are a lot of resources lost from the production of these materials.

Solid wastes identified as solid materials to be disposable as wastes at time of generation and it has no any value to be preserved, however it might be valuable in different position, different circumstances where it can be reused or recycled [3].

The problem of solid waste in Yemen is one of the serious problems that require quick solutions especially with the large population growth rate. Yemen's population is 22 198 000 with an annual growth rate of 3 %, the country has one of the highest population growth rates, with the population expected to double in 23 years to around 45 million (Fig. 1).

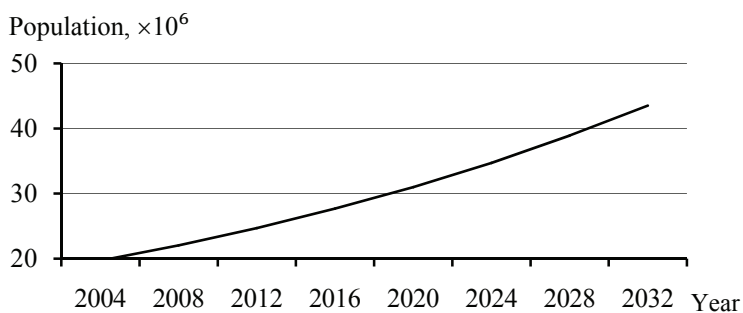


Fig. 1. Population growth rate in Yemen is expected until 2032

Аль-Ахваль Несрен Ахмед Серхан – аспирант кафедры «Гражданское строительство и прикладная экология», e-mail: Nesreen.al-ahwal@yandex.ru, ГОУ ВПО «Санкт-Петербургский государственный политехнический университет», г. Санкт-Петербург.

On average, one person in major cities of Yemen has from 0,5 to 0,7 kg/day of garbage and from 0,3 to 0,4 kg/day in smaller cities. Sana'a is a capital city of Yemen with a population of more than 2 million and the extent of solid waste generated from the city is estimated to be 519674 tons per year. On average 49 % of all waste is organic waste, 8,6 % plastics, 3,6 % Fabrics and textiles, 4,1 % glass (Table 1).

Through our study of the components of waste in Sana'a, we found that it is better to recycle the following items:

- Polyethylene;
- Glass;
- Paper.

Those require a large amount of energy and resources to produce (Table 2, Fig. 2).

Table 1

Morphological structure of solid waste in Sana'a

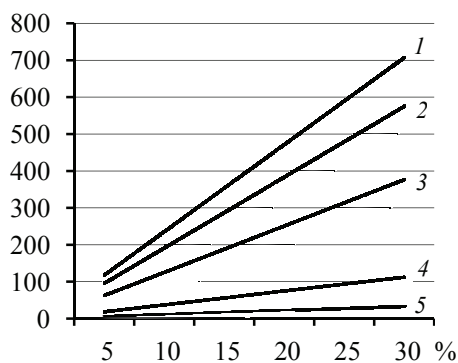
Component	The content of solid waste, %
Organic waste	49
Plastic material	8,6
Metal	5
Bone	1,2
Textiles	3,6
Glass	4,1
Paper	16,6
Other waste	11,9
Total	100

Table 2

Energy and resources consumption in the production process (products) in Sana'a

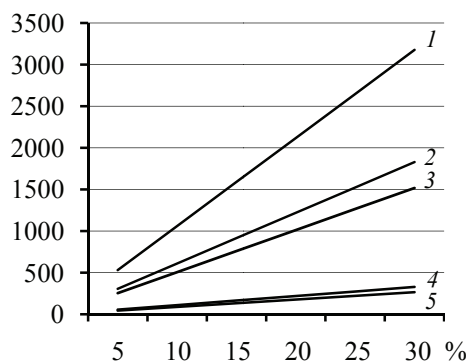
Product Type	Lost energy, MJ/t (Textile, MJ/1 thousand m ²)	Lost Water, m ³ /t	The selected fraction	Saving Energy, MJ	Saving water, m ³
Metal	2000	250	22045	44·10 ⁶	6·10 ⁶
Glass	390...480	600	18077	9·10 ⁶	11·10 ⁶
Textile	3600...9000	2000	15873	143·10 ⁶	32·10 ⁶
Paper	2340	1500	73190	171·10 ⁶	110·10 ⁶
Plastic	10200	500...1000	37918	387·10 ⁶	38·10 ⁶

Saving water × 10⁶, m³/t



a)

Saving energy × 10⁶, MJ/t (Textiles MJ/1000m²)



b)

Fig. 2. Saving water (a) and energy (b) in the production process (products) in Sana'a:
1 – plastic; 2 – paper; 3 – textile; 4 – glass; 5 – metal

The main problems and constraints facing the proper management of solid waste in Yemen are summarized as follows.

1. Mixing of all types of wastes in the same final disposal site due to absence of separate systems for management of other non hazardous wastes.
2. Lack of effective recycling projects for solid waste.
3. Absence of the technical infrastructure of solid waste treatment and disposal and specialized laboratories and monitoring system.
4. Shortage in the detailed studies that identify sources, problems and impacts of solid Waste on the facilities
5. Shortage in the technically skilled personnel and specialized manpower in the area of solid waste and insufficient training and capacity building-programs.
6. Insufficient financial resources to deal with the high investment cost required for the establishment of an appropriate, safe treatment and disposal facilities for each industrial establishment.

References

1. Al-Ahwal, N.S. Recovery of Ceramic Compositions with High Merits on the Basis of Slags and Fly Ashes by Burning Activated Sludge / N.S. Al-Ahwal, V.A. Yarcsev, E.G. Semin // XXXVI неделя науки СПбГПУ : материалы Всерос. межвуз. науч.-техн. конф. студентов и аспирантов / С.-Петерб. гос. пед. ун-т. – СПб., 2008. – С.119–120.

2. Al-Ahwal, N.S. The Effect of Solid Waste Management in Pollution the Environment in Yemen / N.S. Al-Ahwal, E.G. Semin // Науч.-техн. ведомости СПбГПУ. Сер. Наука и образование. – 2010. – № 100, т. 2. – С. 209–215.

3. Ali, A.A. The National Strategy of Integrated Management of Hazardous Waste for the Implementation of Basel Convention in Republic of Yemen / A.A. Ali. – 2004.

4. Аль-Ахваль, Н.С. Решение проблемы ТБО в Йемене: первые шаги / Н.С. Аль-Ахваль, Е.Г. Семин // Экология и жизнь. – 2010. – С. 34–35.

Экологические выгоды от переработки твердых отходов в Йемене

Н.С. Аль-Ахваль

*ГОУ ВПО «Санкт-Петербургский государственный
политехнический университет», г. Санкт-Петербург*

Ключевые слова и фразы: пластик; стекло; твердые коммунальные отходы; энергетические ресурсы.

Аннотация: Рассмотрены результаты анализа морфологического состава твердых отходов г. Сана в Йемене. Статья посвящена современному состоянию проблемы обращения с отходами в городе, принимая во внимание значительный рост численности населения в Йемене, который занимает пятое место по уровню рождаемости в мире. Статья демонстрирует преимущество метода сортировки, что дает возможность естественным образом сберегать энергетические ресурсы.

© Н.С. Аль-Ахваль, 2011