ZESZYTY NAUKOWE POLITECHNIKI ŚLĄSKIEJ 2007
Seria: BUDOWNICTWO z. 112 Nr kol. 1763

Helena ŠEVČÍKOVÁ*
Brno University of Technology

THE ANALYSIS OF THE PROBLEM OF HANDLING WITH SOLID HOUSEHOLD WASTE

Summary. The waste, his beginning and possibilities of disposal are one of the biggest problems of current society. The conception of waste disposal should solve not only reduction of waste production and provide their ecological disposal but also a little bit neglected transport of the waste. There are different ways how to transport garbage. The method used for transport depends on type of waste and of course on the way of its disposal.

In this work will be introduced various ways of transporting solid waste from households and from residential area. The systems of waste handling are described with their advantages and disadvantages. The point of the paper is mainly to motivate readers to think about waste transport.

ANALIZA PROBLEMU ZAGOSPODAROWANIA STAŁYCH ODPADÓW GOSPODARCZYCH

Streszczenie: Mnogość źródeł powstawania oraz możliwości utylizacji odpadów są obecnie jednym z największych problemów współczesnego społeczeństwa. Odpowiednia koncepcja utylizacji odpadów powinna być oparta nie tylko na redukcji ich produkcji oraz możliwościach naturalnego rozkładu, ale także uwzględniać odpowiednie metody ich transportu, co jest często zaniedbywane. Wyróżnić można różne rodzaje transportu śmieci. Zastosowana metoda zależy od rodzaju odpadów oraz oczywiście od sposobu ich utylizacji.

W referacie zostaną przedstawione różne metody transportu odpadów stałych, powstałych w gospodarstwach domowych i obszarach mieszkalnych. Opisane zostały także systemy przeładunku odpadów wraz z ich wadami i zaletami. Głównym celem referatu jest wzbudzenie świadomości istotności doboru odpowiedniego rodzaju transportu odpadów.

1. Introduction

Waste is unnecessary thing, which brings many ecological and economical problems. Production of wastes goes together with each doing of people. Waste is impact of industry, agriculture and also households. The quantity of waste, which people produce, is rising with

* Opiekun naukowy: Ing. Karel Čupr CSc.

living standards of inhabitants. However, the most advanced civilisations can optimize production of their waste and can use the waste like raw material. The reusing of some waste is known for a long time, for example using glass fragments for making glass. The reusing of waste has been developing very successfully in these days. But one point of waste problems, which still stands in the boundary of our interest, is handling with waste. Especially the handling with waste from households is not developed in Czech Republic despite of fact that the current bad state is well known. This paper introduces solutions of this problematic.

2. System – the base of the live

The base of ecological and economical way how to dispose waste (not only household waste) is creating a system i.e. creating compact conception, which determines how, who and where will treat with waste (or its component). This system has to solve treatment with waste from its production and its producer to the way of its recycling or disposal. The system of treatment with waste can be divided to these parts:

- Collection, sorting and trimming waste.
- Handling with waste in a building.
- Transport waste i.e. transport from building to the place of disposal.
- Recycling or disposal waste.

There are many available components in household waste. Their properties and quantity is depended on kind of house-building (country build-up area, urban homestead or mixture of both), prevalent way of heating and time (season) too. The main problem, results from mentioned, is how to determinate which sort and quantity the waste is and also recycling or disposal possibilities. The way of collection, eventually trimming of given components and subsequently way of transport to the disposal is determined by mean of this information.

3. Summary of systems of handling with solid household waste

3.1. Conventional solution

The conventional solution of handling with solid household waste is collection, sorting and eventually trimming directly by producers of wastes i.e. inhabitants of households. The

waste is collected to different bins and sacks and than it is handled from the original place to the collection vessels (dust bins or waste container) which are placed in front of the house. The collection vessels can be divided according to kind of waste – separately for sorting components and for mixed waste. The transport of waste is provided by collection vehicles. The waste is moved from collection vessels to loading space of vehicle by collectors. The low specify gravity which demands using vehicles with press, which provides usage of vehicle load limit. The collection of waste in special vessels is provided by vehicles with hydraulic arm and container carriers (waste is carried out with collection vessel, which is replaces by empty other). The collection vehicles drive waste direct on place of disposal.

Advantages of this system:

- Low cost of sorting and vertical handling (it is provided manually by inhabitants of building).

Disadvantages of this system:

- Wastes are stored in an unsuitable way until they are driven.
- Organics waste is fouled and it causes infections, the present of wild rodents and smell.
- The places of collection vessel are unaesthetic.
- Handling with collection vessel demands big physical force.
- Waste collection vehicles affect fluency of the traffic and moreover parked cars affect collection by waste collection vehicles.
- Hygiene requirements are not filled during loading by collection vehicles.
- Individual waste components are contaminated by the others.
- The collection by collection vehicles disturbs people by noise.

3.2. Conventional system with refuse chutes

The refuse chutes were developed to use the convenience of vertical handling of solid household waste i.e. carrying wastes out to place with collection vessels. The refuse chute is vertical shaft, which is used for disposal waste from every floor to the lowest floor, where the collection vessels are placed. Users are provided by collection and eventually trimming waste (some of chutes demands packing waste to special sacks). The possibilities of sorting waste are very limited. One of them is using colored sacks to sort waste. The transport of the waste from building is provided by conventional collection vehicles.

Basic division of refuse chutes:

- Cold refuse chutes.
- Hot refuse chutes.
- Wet refuse chutes.

Cold (dry) refuse chutes – chute shaft leads to collection room, where collection vessels are placed. This kind of chutes is used in alternative such as linen chute in hotels and hospitals (complemented with disinfection of washing).

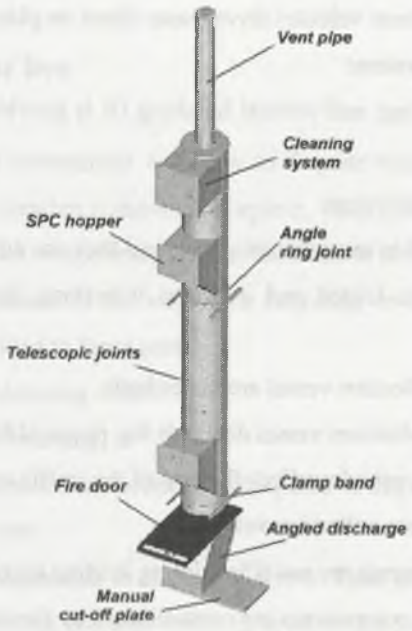


Fig. 1. Cold refuse chute [6]
Rys. 1. Rynna na zimne odpady [6]

3.3. Conventional system with multi-phases driving waste

Small vehicles with electric drive are used in historical centers, where conventional collection by large vehicles is not possible because of narrow streets and traffic. This way of doorstep collection connects conventional system of collection, sorting and handling with waste in buildings. These small vehicles are driven by waste collector, who is walking next the vehicle. The size of the vehicles doesn't disturb fluency of traffic. The vehicles doesn't annoy neighborhood by noise or by exhausts. The small vehicles are used for collection recyclable materials from 100 000 households in London suburbs. The collected waste is

deposited, in accordance with its sort, to different large colored sacks, which are placed on the board of vehicle. When the sacks are filled, waste is driven to parking or other free place being unloaded there. Waste collected by six or eight small vehicles is driven by one larger vehicle [2].

3.4. Pneumatic piping systems

The progressive methods were developed for large residential areas or large buildings for waste handling. These methods are hydraulic and pneumatic piping system.

Pneumatic systems use pressure of transport gas (mostly air) on garbage. The system should be overpressure or under pressure (in accordance with place of exhaust blowers). Pneumatic systems are divided according to circulation used gas per open, semi-closed, closed.

Pneumatic systems are divided in accordance with trim of waste to:

Without grinding waste (system Envac-vacuum waste collection) – it is the most used system of piping systems in Europe. Waste is deposited through an intake door (service operated) and then waste falls down through refuse chute. There is discharge valve in the end of chute. After being opened the refuse is moved by suction which is provided by exhaust blowers. In the end, the refuse is conveyed to a refuse collection room.

With grinding waste (system Optima)

Transport waste in containers – the system is in use for long distances. It demands building of charging and unloading stations [4].

Fig. 2. Vacuum waste collection [5]
Rys. 2. System odkurzania śmieci [5]

Advantages: simplicity of the system, adaptability for conveys in residential areas, there aren't problems with traffic. The great advantage is keeping dust, harmful substances and bed smells in the pipe (system is gas proof). Also possibility of sorting waste – number of chutes conform to numbers of sorting components, transport pipe is only one [4].

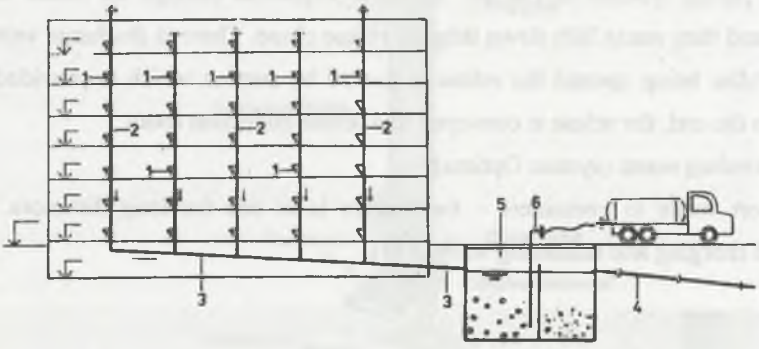
Disadvantages: irresponsibility of system (in case of clogging), abrasion all parts of system [4].

Examples of usage: System Envac was installed in historical Centrum of Palma se Mallorca, Spain or in new built residential area in Havnestad city, Denmark [5].

3.5. Hydraulic piping systems

With own sewerage net (system Gachey) – system uses wet refuse chute and own sewerage net. Wastes are handled to the place of disposal by water [4].

With separate sewerage combined with carrying wastes out (system Mattew-Hall). The system was developed from the previous one. The waste is handled by wet refuse chute to a sedimentation tank. It is pumped and carried by special vehicles. Residue water is transported to conventional sewerage net see Fig. 3 [3].



Rys. 3. Hydraulic piping system: 1 – refuse intake door, 2 – wet refuse chute, 3 – transport pipe, 4 – conventional sewerage net 5 – sedimentation tank, 6 – special vehicle [3]

Rys. 3. System przewodów hydraulicznych: 1 – ujęcie odpadów, 2 – pionowa rura kanalizacyjna, 3 – rura przyłącza do budynku, 4 – sieć miejska, 5 – zbiornik sedymentacyjny, 6 – samochód opróżniający zbiornik [3]

With common sewerage net – system demands using of grinders, which are either under each sink or one for a house. Sink grinders are used for hygienic handling with green waste from place of its origin. This equipment is the most wide spread in USA, where 15-20% of households use it. The house grinders are situated in ground floor or in cellar. They can be joined with wet refuse chute in multistoried houses. Grinded green waste is handled by conventional sewerage system to disposal place – waste treatment plant. There is about 40% green waste in household solid waste. The rest 60% of waste is handled by conventional

ways, it means by collection vessel and collection vehicles. Sewerage net has to be prepared to handle with this kind of waste [4].

Advantage – fast and hygienic handling with biodegradable waste [4].

Disadvantage – big water requirement, noise of grinders, sorting wastes – this system sort only one component of household solid waste, impossibility of handling with all components of waste.

4. Conclusion – demands on waste handling systems

The system, with respect to different components of waste, should be designed for each particular component. The system has to make compact conception, which determines the way of a component from its beginning to the disposal place; it means sorting, collection, trimming, handling in building and out of building and the way of disposal.

On base of mentioned knowledge main demands on waste handling systems can be:

- simplicity for users,
- reliability,
- ensuring of hygiene while handling,
- working of system has to be safe – mainly fire safe and noiseless,
- The system should provide sorting waste.

LITERATURE

1. Fiala J.: Technická zařízení budov, A- Zdravotní technika Přednášky I.díl, Hygienické místnosti a kanalizace. Vysoké učení technické v Brně, Brno 1984.
2. Kropáček I.: Bez skládek i spaloven: šetrnější, levnější a koncepčnější řešení odpadového hospodářství. Hnutí DUHA, Olomouc 2001.
3. Kucbel J., Fiala J., Ondroušek K.: Technické zariadenia budov II. Vydavatelstvo ALFA, Bratislava 1988.
4. Soukup J.: Nové způsoby odstraňování odpadů (pneumatická doprava). Výzkumný ústav výstavby a architektury, Praha 1990.
5. www.envac.net.
6. www.hardall.co.uk.

Recenzent: Prof. dr hab. inż. Janusz W. Wandrasz