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Potential of waste recycling

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The present paper concerns changes connected with the economy conversion and its consequences connected with a new approach. There are presented proposals and targets in order to ensure a correct accomplishment of propositions and implementation into laws in every EU member country. Also the problematic of zinc portable batteries is outlined.

At present, a conversion from the linear economy to circular economy is put into emphasis. Circular economy is characteristic by its closed loop of both material and energy, whereas the linear economy mainly featuring by depletion of sources, high consumption of products and services and unprofitable throwing of spent unwanted products. Figure 1 shows the concept of linear economy. The purpose of circular economy (Figure 2) is to aim the minimal source input and thus achieve low energy demand and to ensure that output will be recyclable with no dangerous features [1,2].

Priorities of a circular economy are [2]:

- Reduction and effective use of limited primary sources,
- Streamline of product manufacturing for high efficiency and low consumption of sources and low emission production,
- Prevention and low waste production,
- Minimalization of polluting sources,
- Recycling.

To ensure sustainability of system there is need of integration of components such as environment, social sphere, and economy. Action plan of such economy is included in sectors [3,4]:

- Plastic
- Food waste
- Raw critical sources
- Construction and demolition
- Biomass and bioproducts
- Innovation and investment in researches and projects.

The benefit of waste management relies on overall cost reduction, sanitation of all parts of the environment and creation of new working places.

Targets of European commission are [4-6]:

- 65 % recycling of municipal waste by 2030
- 75 % recycling of packaging by 2030



Fig. 1: Linear economy

- Reduce landfill to maximum 10 % of all waste by 2030
- EU states cooperation – improve waste management
- Ensure structural funds are use for support of waste hierarchy : prevention – reuse – recycling – energy recovery
- Rewarding producers who put a greener products on the market
- Ensure of using BAT and BREF documents for industrial waste
- Food savings on half
- CRM – critical raw material - Preparation of best practices, ecodesign, improve recyclability

European Union wants to achieve a leadership towards transformation to circular economy, to offer opportunity for innovation in new materials, and ensure better products and services, job creation, at the same time. The EU package requires diverse business and financial model together with technological and social innovations, and experience or knowledge obtaining through education [1-6].

Better design may lead to more durable, repairable, upgradable or innovative products. It can help recyclers to dismantle products after their life and to gain a valuable components and materials. Overall, proper design may save primary sources. This plan seems to be very unreal when compare the present status on the market, because interests of producers, consumers and recyclers are not the same. Thanks to that, the EU will support eco design by creation of relevant requirements on products placed on the market according to directive about eco-design [3,7].

Increase of waste recycling rate is one option how to contribute to function-

ing of circular economy. Recycling itself is complex process depended on various factors, such as kind of waste, complexity of materials, characteristic of waste, available technologies for its treatment and so on. In the present time, there are plenty of wastes that can be treated by modern technologies, but they are not separated from municipal waste in high rate, for example electronic devices, primary batteries, metal cans, and others. In such wastes not only metal component, but also other parts

can be recycled. When focusing on metals, because of its high demand on the market and low primary source, recycling seems to be very reasonable solution in this case.

Zinc based waste are for instance: spent zinc batteries, steelmaking dust, galvanizing waste and others. Spent zinc batteries contain valuable metals, which can be recovered by various methods and used again in production of batteries as well as in another product.

Methods used for recovery of valuable metals from spent zinc batteries are hydrometallurgy, pyrometallurgy and its combination. Both methods can be used after physical pre-treatment step (such as dismantling, crushing, milling, sieving, and magnetic or eddy – current separation) before main process of component recovery. Pre-treatment is a step not necessary in case of pyrometallurgy treatment, but it can make easier the process of recovery of individual components from batteries. In the opposite, hydrometallurgical process does require this step, because without pre-treatment of batteries, it is not possible to ensure leaching of active mass followed by metal recovery. Hydrometallurgical process is based on acidic or alkaline leaching from the active mass and metal recovery. Prevailing usage of such method is for low metal content wastes. Hydrometallurgy became a reasonable and effective way for metal recovery from primary sources as well as from secondary ones. The method is characterized by several steps such as pre-treatment, leaching, pH modification, metal recovery from a solution etc. [8].

In the opposite, the high metal content waste is basically treated by pyrometallurgy. Those processes are mostly used

in the industry and they are based on vaporization and condensation of metals, followed by concentrating of additional components in the residue. Generally, such methods can be considered as the most common method in the sphere of batteries recycling [8,9].

In a present time, a few collecting places without processing are built for collection of spent batteries and accumulators in Slovakia. Because the amount of collected batteries and accumulators is under the 1000 tonnes, their processing cannot be economically effective. Machtrade s.r.o., that recycles mostly lead based wastes by technology from the company Engitec Impianti S.p.a., is the biggest processor in Slovakia. The current method used for this process is BAT (Best available technology) technology [10,11].

Conclusion

In a few years, waste should replace primary sources more widely. Economy should head to more green and environmental perception. The human behavior should transform from the very beginning. All those important things should be followed according to a new European commission package. This transformation will be very hard and demand, but the purposes are set and now it is up to every member state of

the EU to implement them into laws and directives and into general awareness.

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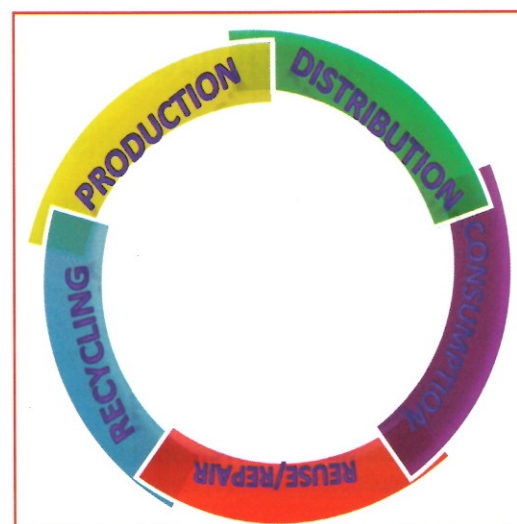


Fig. 2: Circular economy

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