A look into the circularity of waste water sludge in Portugal: context, constraints and opportunities

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Abstract (300 words)
The Portuguese action plan for the circular economy, proposes under action #6, the need to increase the efficiency of water use and reuse, as well as the improvement in the valorisation of nutrients present in waste water sludge. In 2014, last data available, only 52% of the sludge was subject to valorisation, indicating a significant room for improvement. This paper aims to analyse the potential for improvement in the quantity of sludge from WW subject to valorisation. To this end, the installed capacity to valorize sludge and its location is compared with the quantity of sludge produced and its location. Preliminary results indicate a clear mismatch between the distribution of installed capacity for biological treatment of WW-sludge and the distribution of waste water sludge produced.
Keywords: Circular economy; sludge management; Agriculture; Compost.

INTRODUCTION

Following the development of the circular economy package in the EU, Portugal has developed several legislative initiatives to facilitate the transition and implementation of the circular economy paradigm. The implementation of the new paradigm requires challenging transformations, in production, transport and consumption models across sectors. It involves the transformation of business models, adoption of new practices and lifestyles by consumers, the creation of new products and services, among other changes.

The legislative initiatives in Portugal are dispersed over several legal documents. In particular, the government released an Action Plan for the Circular Economy, which is under public consultation until September 30th, 2017.

The document is divided into areas of intervention, identifying the institutional actors, the economic sectors of activity, objectives, orientations, and indicators of progress.

The actions proposed are: #1- Reuse and communicate: extended producer responsibility; #2- Promote markets for responsible and circular production, use, and consumption; #3- Knowledge, learning and communication: educate for the circular economy; #4- Food waste- food without waste; #5- New life for residuals; #6- Regenerate resources: water and nutrients; #7- Research and innovation in the circular economy.

As evident from the designation of the actions, the water sector in comprised under action #6. This Annex I to the action plan describes the present situation with respect to water and WW. Regarding WW, in 2011, 33% of the sludge was subject to a valorization process, and only 0.1% of the WW was reused; in 2014, although some improvement was achieved, still only 52% was subject to valorization. This paper intends to analyze the potential for improvement in the quantity of sludge from WW subject to valorization. To this end, the installed capacity to valorize sludge and its location is compared with the quantity of sludge produced and its location.

METHODOLOGY AND RESULTS

According to a report published by Portuguese environmental agency (APA, 2013), 61% of total sludge produced in Portugal was in urban WWTPs (waste water treatment plants), representing 393

025 tons, corresponding to a total of 5 685 483 inhabitants (for an average of 0.069 tons/hab).[1] Of the total Sludge produced, only 5% was eliminated (95% theoretically was transformed in some way). However, a careful examination of the data, reveals, that 47% is stored for future use, in 2013, only 28% were transformed. In fact, only 27% was used for agriculture, and a mere 23% was transformed by some biological process. Thus, approximately 50% of total sludge produced in urban WWTPs was not valued at all. Moreover, the fraction valued in agricultural uses, or transformed using biological processes has decreased over the years (from 68% in 2010, to around 50% in 2013).

There are several possible explanations for the present situation. The present paper proposes two possible explanations, (i) deficient treatment and/or logistic infrastructures, and (ii) social acceptance. Wustenhagen et al, (2007) proposes a triangular model for social acceptability of an innovation. The vertices of the triangle are social-political acceptance, community acceptance and market acceptance. Social-political acceptance regards to the acceptance of the innovation by policy agents; community acceptance refers to the acceptance of treatment plants by local communities; market acceptance regards the confidence of buyers regarding the characteristics and price of the product resulting from the innovation. In the case of biological treatment of urban WW sludge and its use in agriculture (R3 and R10), Table 1, compares the regional distribution of installed capacity for biological treatment of urban WW sludge in 2013 (APA, 2013) with the regional distribution of the population. It is clear the mismatch between the installed capacity and the distribution of sludge generated, assuming an equal per capita urban WW sludge production.

Table 1. Regional distribution of installed capacity for biological treatment and resident population (2011).

Region	Population (%)	Installed capacity (%)
North	35	12
Centre	22	48
Lisbon	27	19
Algarve	4	3
Alentejo	7	19
Açores	2	0
Madeira	3	0

CONCLUSIONS

Preliminary data analysis clearly indicate one barrier/opportunity to increase the fraction of WW-sludge valorised: to improve the location of valorisation plants to match the distribution of WW-sludge production. In addition, interviews with experts in the field indicate a significant lack of market and community acceptance of products generated from urban WW-sludge.

REFERENCES

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[1] According to APA (2013) there is a discrepancy between the amount of sludge produced and that received by treatment plants. The number reported refers to sludge produced; sludge received was, in 2013, 388313 tons.