# Application of ontological information system for the selection of anaerobic digestion equipment

***Tarasenko R.A., Usenko S.A., Shapovalov Ye.B., Shapovalov V.B.***
*National Center «Junior Academy of Sciences of Ukraine»,*
*gws0930191302@gmail.com*

Ontology widely used to support various types of information management including information retrieval, storage, and sharing on the web. To construct ontologies special software are using, which allows users to build hierarchies and create semantic links. A range of open-source and commercial tools are available. They assist in the development of various ontologies, and called Ontology Editors. Today a variety of developing environments are used to create ontologies like Protégé 3.5 [1], Apollo [2], SWOOP [3], IsaViz [4], Polyhedron.

This paper aims to propose a system which has systematized the selection of anaerobic digestion equipment, using the cognitive IT-platform Polyhedron, to implement the ontological system in environmental management. The core of the Polyhedron system contains advanced and improved functions of TODOS IT-platform which were previously used to provide semantic web, systematization, transdisciplinary support, GIS connectivity, and ecological management.

Ontologies have created by tools of IT-platform Polyhedron. Two types sheets, .xls to create structure (hierarchy of nodes; in further - structure file) and .csv to add internal information for both, numeric and semantic data (in further – data file) was uploaded to Ontology Editor to generate hierarchy. After generation, ontologies were uploaded to the store (if it was necessary to use ranging, it was chosen). To store information and provide its sharing, google sheets were used, with their further conversion into the .xls and .csv Excel sheets (Figure 1).

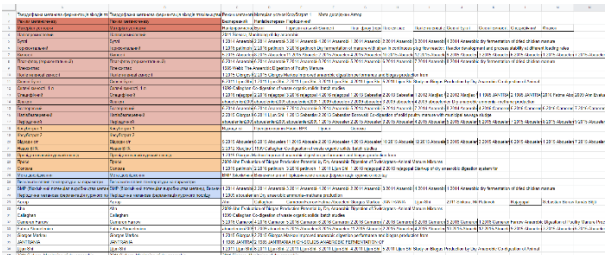

Fig. 1. Google sheet with data

Semantic characteristics for the ontology “waste treatment equipment selection”, has been obtained from legit scientific sources [5–10]. In this way, an ontology “waste treatment equipment selection” was created to solve the problem posed in this paper.

In this case, child nodes criteria will be: minimum and maximum operating temperature (ºC), minimum and maximum possible COD (g O2/m3) of the loaded substrate, values of COD (g O2/m3) after treatment, minimum and maximum possible loading (kg VS/ m3) on the reactor, maximum and minimum humidity of the loaded substrate (%). The general view of the filter system in the table form shown in figure 2.

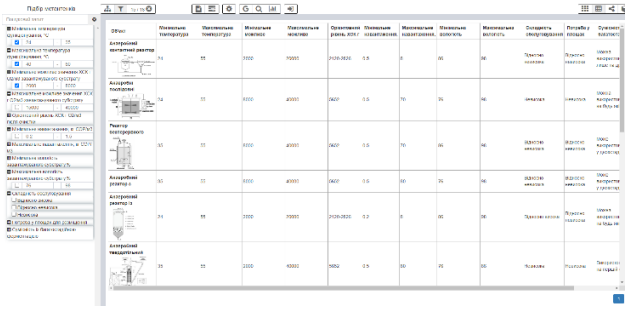

Fig. 2. The general view of filtering input system of selection of anaerobic digestors on the table form

Thus, the” Polyhedron” system allows to obtain the system of decision-making for the selection of anaerobic digesters.

## References

1. http://protege.stanford.edu: URL: http://protege.stanford.edu.
2. http://apollo.open.ac.uk/index.html: .
3. Kalyanpur, A., Parsia, B., Sirin, E., та ін. Swoop: A Web Ontology Editing Browser. Web Semantics. 2006. Vol. 4, No. 2. C. 144–153.
4. http://www.w3.org/2001/11/IsaViz/Overview.html: .
5. Mao, C., Feng, Y., Wang, X., та ін. Review on research achievements of biogas from anaerobic digestion. Renewable and Sustainable Energy Reviews. 2015. Vol. 45. C. 540–555.
6. Deng, L. W., Zheng, P., Chen, Z. A. Anaerobic digestion and post-treatment of swine wastewater using IC-SBR process with bypass of raw wastewater. Process Biochemistry. 2006. Vol. 41, No. 4. C. 965–969.
7. Li, Y., Zhang, R., He, Y., та ін. Anaerobic co-digestion of chicken manure and corn stover in batch and continuously stirred tank reactor (CSTR). Bioresource Technology. 2014. Vol. 156. C. 342–347.
8. Wang, Y., Liu, X., Zhuang, W., та ін. Advance: IC reactor for high strength industrial wastewater treatment and biogas production. ICMREE2011 - Proceedings 2011 International Conference on Materials for Renewable Energy and Environment. 2011. Vol. 1. C. 423–427.

9. Militon, C., Hamdi, O., Michotey, V., та ін. Ecological significance of Synergistetes in the biological treatment of tuna cooking wastewater by an anaerobic sequencing batch reactor. Environmental Science and Pollution Research. 2015. Vol. 22, No. 22. C. 18230–18238.
10. Şentürk, E., Ince, M., Engin, G. O. The effect of transient loading on the performance of a mesophilic anaerobic contact reactor at constant feed strength. Journal of Biotechnology. 2012. Vol. 164, No. 2. C. 232–237.