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MARKETING LETTER

INSTALLATION FOR SURFACE INLAND WATERS RECLAMATION TO EXPLOIT BOTTOM NATURAL SEDIMENTS (BNS) BY THEIR BIO-GASIFICATION WITH CONCURRENT USE OF THE (BNS) FOR AGRICULTURAL NEEDS – AS SOIL FERTILIZERS

Applications:

One of the ways to exploit energy potential of the bottom natural sediments is their bio-gasification to obtain as the end results variety of energy forms as is listed below:

- electric energy (mainly gas engines and fuel cells in future)
- thermal energy (cogeneration, gas boilers or for gas networks after standardization of biogas),
- fuel for vehicles (after purification and compression).

Research results of the methane fermentation process residues of the bottom natural sediments, i.e. the after-ferment, reveal that it may be used as well in agriculture to improve soils quality.

The basic factor that influences efficiency of the bottom sediments energy exploitation is availability the sediments and the availability should be each time determined through examinations (e.g. bathymetric or by direct underwater measurements) of water body or water bodies from where the sediments are intended to extracted..
Results of the analyses performed show that for the biogas-works with 0.5 Mega Watt power efficiency, the annual demand for bottom sediments is ca 26 000 m^3 and with the assumed 25 years life duration of the biogas-works the minimum quantity of bottom sediments should be at least 650 000 m^3.

The second important factor influencing efficiency is the methane potential of the bottom sediments that may be strongly variable and amounts from 30 to about 120 m3 of biogas from 1 ton of sediments.
The methane potential of the bottom sediments depends of:

- kind of the water body,
- layer (depth from where the sediment is extracted),
- method the sediment is extracted with.

The potential should be determined basing on the methane potential laboratory researches of the bottom sediments samples taken from different layers of sediment in purpose to determine an average potential of the entire amount of bottom sediments mass intended to be extracted for biogas production.
It results from the analyses performed that the average value of the methane potential of sediments intended to be used for biogas production should amount to at least 60 m^3 of biogas from 1 ton of sediments.
In case of the bottom sediments with methane potential below 60 m^3 of biogas from 1 ton of sediments it is recommended to take into account possibility to add bio-components to the biogas production process.

A consecutive and crucial factor decisive on efficiency of the venture is quality of the bottom sediments – degree of their pollution that influences on decision of suitability of the sediments to be used in the for energy production process.
A decisive factor on efficiency of the project are its purposes - is the bottom sediments processing intended as commercial one or as an element of the water body reclamation.
If the biogas production is an element of water body reclamation process, greater is the efficiency of the project than when the sediments processing is used exclusively for commercial production of energy.

An estimated installation cost to extract bottom sediments from water bodies and to submit them to biogas production process with biogas-works capacity of 0.5 Mega Watt amounts to about 13 – 16 mln PLZ, depending of the installation solutions applied.
Installations for biogas production from bottom sediments may be assumed as investments with an average negative risk level for the environment impact.

The analyses undertaken have confirmed that an investment to build a biogas-works with use of the bottom natural sediment (BNS) as the basic substrate, i.e. parent substance, may be considered as a profitable one and the direct period of repayment is from 8 to 10 years.
The bottom natural sediments may constitute a raw material for production of a medium that improves properties of soils and such installation concurrently with biogas-works as source of heat – importantly increases economic profitability of the installation.
The Habitat Foundation has elaborated documentation of installation to produce media that improve properties of soils and productivity of the installation enables to process up to 2 Mg/d of sediments. Estimated cost of an installation producing medium in form of a granulated mass amounts to 4 million PLZ.

Exploitation of bottom sediments, obtained in the water bodies reclamation process, for energy production, is an innovative solution not applied presently in domestic and foreign practice. For this reason the researches and analyses performed that are approached in this elaboration, have not only permitted to qualify positively verification of the hypothesis that bottom sediments may be exploited for production of heat and bio-fuels, but also permitted to go through a patent procedure that resulted in patent admission: ***"Fuel material containing bottom sediments and combustible material"*** (PL 223699) The patent object is a fuel material that comes into being from mixture of waste materials of organic origin, mainly from bottom sediments, mixed with wastes of combustible materials of a significant calorific value. Just to mention here rape ground grain, rape pollutions, straw, coal dust, coal wastes, bone meal, sawdust, timber chips, etc. The result constitutes a cheap and ecological combustible material with a significant

calorific value, intended for common combustion in stoves/ovens, fireplaces, etc. as well as co-combustion material in power plants to decrease sulfur emission.

In a stage of patent notification (P. 431206) is presently an invention related to production of ecological bio-fuel obtained from the bottom natural sediments used with addition of bio-components, the invention being based on technology friendly to human environment.
According to this invention, the essence of the new method to obtain the bio-fuel consists on an idea that the raw bottom sediment, after filtering and removal of stones, is entered to a fermentation chamber that is equipped in a heat exchange system and also implanted with a high quality anaerobic active sediment being in a form of a conglomerate of hydrolyzing and acidifying microorganisms and methane bacteria in a stadium of stagnation.
The fermentation chamber is kept in temperature $35 \div 45^0$ C for mesophilic fermentation and in temperature $50 \div 65^0$ C for thermophilic fermentation to ensure control of the maximum enzymatic activity of microorganisms and an adequate growth. The fermentation period lasts 8÷14 days and then the sludge obtained after the fermentation undergoes a renewed fermentation during consecutive 8÷14 days in the ambiance temperature. The bio-gas obtained may be burned out on site to procure heating energy or/and to procure electric energy. The bio-gas after purification and enrichment in form of bio-methane additive may be forced after compression into gas network (CBM – Compressed Bio-Methane) or be used as a transportable fuel after its liquefying (LBM Liquid Bio-Methane). Then bio-gas converted into bio-methane form enables to use bio-gas outside the place of its production. The next step is fractionation of the biogas-works products to get liquid and solid parts. The liquid fraction is purified to remove organic and nutritious compounds and then is returned to rivers/lakes or purified with use by a swampy hydro-botanic method to procure valuable constituents from its upper layer.
The solid fraction may be used alternatively. The first option is addition of bio-components to the bottom sediment after its filtration. Then the product undergoes drying with use the waste heat created by bio-gas process and bio-gas combustion. As a result of the briquetting process is then manufactured solid fuel material. The second option is to use the solid fraction as organic fertilizer following the previous composting.

The proposal constitutes a result of projects elaborated and finished by „HABITAT" Foundation i.e. „Production of ecological fuel from the bottom natural sediments with addition of bio-components and basing on environment friendly technology" and „Production of media that improve properties of soils basing on the bottom natural sediments obtained in the process of water bodies reclamation".
Realization within the confines of the Priority Keystone 1.
Strengthening of innovativeness and competitiveness of the region economy, action 1.2 Promotion of companies investments for innovative researches , sub-action 1.2.1. Support of the research and development processes within confines of the regional Operational Program of the Kujawsko-Pomorskie Province in years 2014-2020.
The elaboration over here is based on 223699 patent – „Fuel material containing bottom sediments and combustible material" as well as patent notification „ Method and system to produce bio-fuels from the bottom natural sediments with additive bio-components" – patent notification No P.431206 dated 19.09.2019 of Stanisław Borsuk authorship – patent law firm Piotr Jankowski.
Presently we prepare a research and implementation program to complete a list of products that are possible to obtain from the bottom natural sediments (BNS) with use of the known technologies, i.e.: „Concept and implementation to obtain products of alcoholic distillation based on the bottom natural sediments (BNS) with bio-component additives (BC), where the BNS is going to be obtained by the way of friendly to environment technology of surface waters reclamation".

As a target we are intending to realize a research and implementation program of „Concept and implementation of a target and pilot investment program to build a biogas-works and fertilizer plant whose operation will be based on exploitation of extracted bottom natural sediments (BNS) with bio-components (BC) additives where the BNS will originate from water bodies and rivers".
The investment will be located on land and on surface of water basin and localized in the territory of Osie commune at the side of Żurski artificial lake – the water body that has been universally researched for its purpose, and the investment has its backing from the side of the commune authorities. The area in question is already chosen and presently the purchase formalities are on the way to be completed.
It is intended to adapt Aquamec dredging concept/technology and to use geo-tubes to store the dredged material, i.e.: the bottom natural sediments .
Technology of "Habitat" Foundation will be adapted to process the dredged bottom natural sediments.

To realize the project we are intending to obtain EU financial subvention as well as to find competent partners to create a relevant organizational unit, e.g.: a consortium.
An application to get EU finance support is already significantly advanced.

Besides we are on the stage to publish three books as below:

- Methodology to evaluate quality of water bodies (republication)
- Bottom natural sediment (BNS) as a potential source of renewable energy in the days of energetic crisis
- Bottom natural sediment (BNS) as a potential source to obtain organic media for improvement of soils quality

The books are thematically coherent and illustrate the entire course the research, extraction and process operations that take into consideration equipment and technology of the "Habitat" Foundation and Aquamec as well.
You invited to co-publishing.

We may also broaden collectively versions of the patents possessed - admissible possibility after agreements on principles of co-authorship.

The use of the bottom natural sediment (BNS) with bio-component additives (BC) may: :

- constitute a source of renewable energy,
- influence to increase size of water reserves and to improve their quality,
- participate to obtain natural media that improve properties of soil,
- serve to improve environment and climate conditions,
- lead to improvement of touristic, recreational and spa conditions,
- lead to improvement of navigational conditions,
- serve for reclamation of natural watercourses and water bodies,
- lead to positive changes in demographic conditions.

I consider that combination of extraction and process functions in relation to bottom natural sediments constitutes a solution of the worldwide extent and this is available to gain with our own efforts in cooperation.

Foundation President
Stanisław Borsuk, DSc Professor