MANAGEMENT OF CELLULOSIC BIORESOURCES WITH NEUTRAL IMPACT ON ENVIRONMENT

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Abstract

Changes of economy and society, determined by globalization and EU joining bring and impose, along all of the human activity segments, new informations. The bioethanol is considered as energy source close to neutral carbon, using renewable raw matters already existing, which are not into competition with food and feed production, does not require supplementary field utilization. The cellulosic bioresources, as raw matters for bioethanol obtaining, could ensure benefits for farmers and implicitly, the prerequisite to sustainable development of rural areas. The research is based on specialty documentation and statistical agricultural and environmental analysis. For Romania, the agricultural residues of „issues/pollutants" could become tools of local living, the prerequisite of rural development.

***Keywords**: management, bioresoursces, sustenability, agriculture, residues, environment*

Introduction

The bioethanol obtaining from bioresources is a main issue starting with 70s and require high investments. Efforts to accelerate the technologies development are made and, under advanced performance conditions, the bioethanol could play an important role into bioeconomy on world plane. The impulses come from economical results/product, too: for production, logistics and bioethanol distribution PERSEO (Caterina Coll Lozano, Bioethanol production: Perseo project, 2008) the costs are lower with 86.47% then gasoline 95; the bioethanol price represents 50.22% versus gasoline 95 one (cost and price of gasoline give by CNE - Spanish National Comission for Energy, Published Prices for 1st quarter 2008).

The plant represents the complete production chain, including pretreatment, process-integrated production of feedstock and process specific enzymes, hydrolysis, simultaneous C5 and C6 fermentation and energy saving ethanol separation. The process itself is energy neutral, yielding cellulosic ethanol with about 95% of CO_2 emission reductions (Koltermann, A. et al.**,** 2014). One of the main features of cellulosic ethanol is its particularly high potential for greenhouse gas emission savings, which can reach up to 100% compared with fossil fuel. If agricultural waste is used as feedstock, cellulosic ethanol does not entail any additional land use, nor does it compete with food and feed production (Dunn, J.B. et al., 2013; Maria Blanco Fonseca et.al., 2010; Croezen, H.J. et al., 2010).

As a result, cellulosic ethanol opens up a new domestic source of energy based on renewable feedstock which can be produced on a regional basis without having to cultivate new land. By utilizing residue, additional value is generated for this waste as it helps to diversify farm income. The concept of decentralised plants generates new green jobs, especially in rural areas (Koltermann, A. et al.**,** 2014).

Cellulosic ethanol used as biofuel is the first product derived from lignocellulosic biomass entering the market. Ethanol itself has however many other applications and serves as an important feedstock for the chemical industry. For example ethylene is currently the most important chemical worldwide for conversion into polyethylene. Today’s production is mainly based on cracking of naphtha, but an alternative route would be the conversion of bioethanol via dehydration. In addition, the sunliquid technology generates access to cellulosic sugars and hence creates a platform for a wide range of biobased chemicals such as organic acids, higher alcohols or other specialty and bulk chemicals (Vennestrøm, P.N. et al., 2011; Bozell, J., Petersenb, G., 2010).

By using agricultural byproducts for the production of bio-based products, both plate and tank can be filled, while at the same time protecting climate and the environment and drive economic growth (Koltermann, A. et al.**,** 2014).

Agricultural residues already pose a high potential; they are readily available globally in substantial amounts without interfering with current agricultural practice.

Materials and methods

Promoting the use of bioethanol to replace the gasoline contribute to design of objectives stipulated into Government Ordinance no. 1844/2005, which transposes into national legislation the provisions of the Directive no. 203/30/EC of Council and European Parliament. These consist of: fullfill engagements regarding the climatic changes, ensuring of safety into supply related to environment and utilization of energy renewable resources. Till 2020, the cellulosic bioethanol must cover 25% of fuels global demads.

Bioethanol is used as an additive in gasoline as well as B85 fuel (85% ethanol and 15% gasoline). At present, according to international provisions, the fuels pump must contain biocomponents too; initially, it was optionally. Thus, the figure 1 presents the fuels in Romania, which improve their quality from one year to another, by increasing bioethanol share.

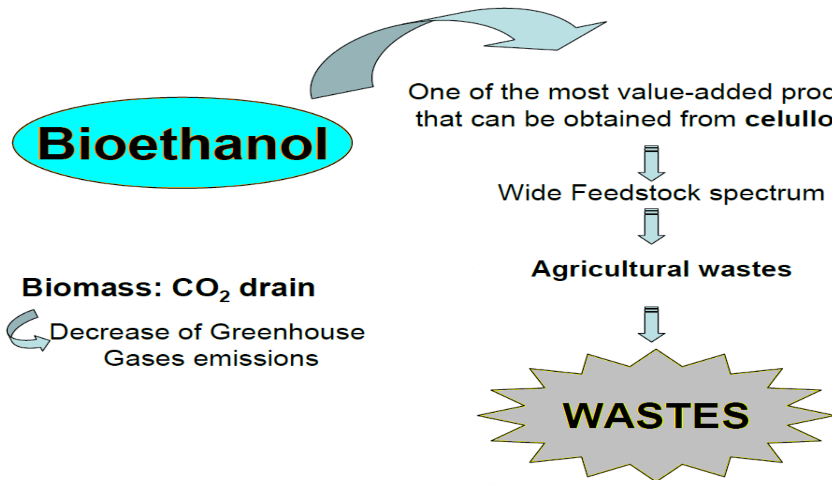
Source: Processing after http://www.insse.ro/cms/files/Web_IDD_BD_ro/index.htm

Figure 1. Biofuel consumption in the transport sector (Romania); share quantities of biofuels in total fuel use for transport (%)

This is could be done by biomass (crops especially sown) as well as public agricultural wastes (vegetal and animal).

Managing by-products, as factor, require specialty trening, performing programs, track results, knowing of market (Iuliana, Dobre, Mariana, Bran, 2007).

Figure 2 schematically shows the categories of raw matters to obtain bioethanol, highlighting the consumption, by plants, of greenhouse gases (CO_2) and therefore, the positive effect on environment.



Source: Caterina, Coll et al., 2009

Figure 2. Second generation Bioethanol (C_2H_6O)

Overall, though, biofuels would by and large reduce emissions compared with fossil fuels. It was largely this thinking that (Croezen, H.J. et al., 2010) was reflected in the sustainability criteria for biofuels that were put in place in the renewable energy directive (RED). Among other things, the Directive requires that the greenhouse gas emissions associated with production and use of biofuels are at least 35% and from 2017 at least 50% lower than those associated with production and use of conventional petrol and diesel. The RED requires that the whole production chain from cultivation of the feedstock up to use of the biofuels is considered, including direct conversion of land to grow biofuels feedstock.

The study is based on analysis of sunflower components to determine the waste quantities, but other statistical data and their processing depending on proposed aim. The research is conducted using the references related to cellulosic bioresources and possibilities to obtain bioethanol. The quantitative determinations are on an average, due to the fact that the agricultural bioresources are conditioned by environmental factors.

Results and discussion

The feedstock potential. *The eco-economical size of two-generation bioresources to produce bioethanol.* At present, for small farmers, the cereals and sunflower by-products represent a stress-issue because of collecting high expenses, having in view that there are not useful for them and represent an impediment to new production establishment. Therefore, these wastes coul become resources for bioethanol obtainment. As quantitative issue, the start is represented by the plant biology, as component structure and yielding potential.

At present, for the above mentioned species, there are lots of cultivars and/or hybrids with various traits, reason for a adequate average utilization. Thus, at 1:1 grain/straws ratio of small grains and 1:1.5 in barley and taking into account the toatl production, average of the last five years (table 1), the straws wastes cumulate 7586.2 thousands tons/year.

Table 1

The evolution of grain production in Romania, thousand tons

Total production of grain, thousand tons	2007	2008	2009	2010	2011	2012	2013	Annual average*
Wheat	3044.5	7181.0	5202.5	5811.8	7131.6	5297.7	7296.4	5852.2
Barley	531.4	1209.4	1182.1	1311.0	1329.7	986.4	1542.2	1156.0
Corn	3853.9	7849.1	7973.3	9042.0	11717.6	5953.4	11347.6	8248.1

Source: 2007 – 2011 – Data NIS – Romanian Statistical Yarbook
NIS – Crop the main crops in 2012-2013
* Personal interpretation

Using the same argument, the maize wastes cumulate annually11617.1 thousands tons.

The references (Cellulosic Ethanol – production and use as an advanced biofuel in Europe.mht), the ratio bioethanol/straws is of 0.18. As follows, into a technological flux (figure 3) of bioethanol obtaining from cereal wastes, 3,456,600 tons of bioethanol could be annually obtained.

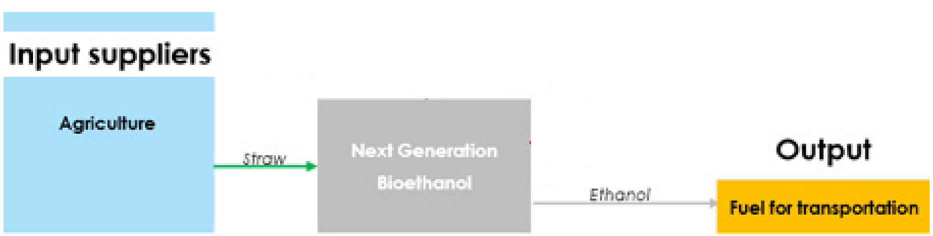


Figure 3. Flux of biofuels obtainment from cellulosic wastes

The using of sunflower wastes to obatin bioethanol represents, beside other agricultural wastes, an economical and ecological alternative to utilize means of conveyance on world plane. In this respect, analyses of crops at NARDI Fundulea were performed.

Table 2

Sunflower components weight, 2014

Plant components	**Number plant**					**The sum (g)**	**The media (g)**	**Proportio of total plant (%)**
	1	2	3	4	5			
Surrendered seed (g)	200	170	230	160	130	890	**178**	40.5
Surrendered without seed (g)	70	60	80	50	50	310	**62**	14.1
Seed (g)	130	110	150	110	80	580	**116**	26.4
Strain (g)	240	170	170	160	90	830	**166**	**37.7**
Leaves (g)	30	40	40	30	30	170	**34**	7.7
Root (g)	80	70	50	70	40	310	**62**	14.1
Total	550	550	490	420	290	2200	**440**	**-**

Source: Personal interpretation

Table 2 presents the components of five sunflower plants of the hybrid Fundulea 780, tested at harvesting, in October. One can ascertain that the stem represents, on an average, almost 50% of the total plant weight. Under theses circumstances and taking into account the data released by MARD (table 3), al national level, the annual average is of 540.66 thousands tone sunflower stems. Therefore, 97,318 tons of bioethanol could be annually obtained.

Table 3

Data regarding the evolution of sunflower areas and yields in Romania

Specification	**UM**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Annual average***
Area	thousands ha	835.9	813.9	766.1	790.8	995.0	1064.8	1097.7	909.17
Average production	kg/ha	654.0	1437.0	1433.0	1597.0	1798.0	1313.0	2001.0	1461.85
Total production	thousands tone	546.9	1169.7	1098.0	1262.9	1789.3	1398.2	2196.5	1351.64

Source: 2007 – 2011 – Data NIS – Romanian Statistical Yarbook
NIS – Crop the main crops in 2012-2013
* Personal interpretation

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Conclusions

The European Parliament permanently argues for using energy renewable resources. Thus, in february 2014, the EU requested that 30% of energy consumption in UE be obligatory achieved by the renewable resources and the objectives regarding the fuels after 2020 be prolonged.

The agricultural wastes, as energetic renewable resources, represent a high potential. They are available in huge quantities, at both national and globel lavel but not affect the current agricultural practices.

The small grains and sunflower cellulosic wastes represent, on an average 19743.96 thousands tons/year. It means, over 3.5 millions tons of bioethanol.

The bioethanol, performed entirely from biological products (crop by-products) gives a neutral impact on environment.

The use of lignocellulosic feedstock for cellulosic biofuels to offer the exploitation of a new and renewable resource, high greenhouse gas savings, reduced dependence on fossil imports, economic growth.

Unconventional alternative fuels, renewable lead to road transport, aviation, marine, rail, cleaner.

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