USAID
NGA POPULLI AMERIKAN
OD AMERIČKOG NARODA

REPORT ON PHYSICOCHEMICAL PROPERTIES (QUALITATIVE) ANALYSIS OF WOOD PELLET

January 2016

This document was produced for review by the United States Agency for International Development. It was prepared by:

Sara & Meti Laboratories, for

Cardno Emerging Markets USA, Ltd., implementing

EMPOWER Private Sector USAID Project in Kosovo

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TABLE OF CONTENTS

MISSION

In order to establish the quality of wood pellet that is being produced and traded in our country, beginning from November 27th to December 13th, 2015, the technical staff members of Sara & Meti Laboratories performed on-site wood pellet sampling from pellet manufacturers and traders.

Pellet sampling and laboratory testing was carried out within the framework of a bilateral contract reached between **Cardno Emerging Markets USA Ltd./USAID's EMPOWER Private Sector Project** and **Sara & Meti LLC** with the purpose of carrying out laboratory tests to determine the physicochemical properties of wood pellets, in other words, of the qualitative parameters indicative of pellet quality.

ACTIVITIES

The activities undertaken encompassed laboratory testing of pellet samples collected from various manufacturers in the country which are available in the market for Kosovo citizens. During this research, international standard methods in use in developed countries for determining the quality of wood pellets, such as ISO and EPA, were utilised.

BASIC REGULATION

The basic Regulation which formed the basis for the laboratory tests of wood pellet samples was the New European Pellets Standard EN 14961-1, attached as an Annex to this Report, as a point of comparison of results obtained from these laboratory tests. The EN 14961-2 Standard can also be used for the categorization of wood pellets in corresponding classes, and Table 1 shows parameters which must be met in order for wood pellets to be fall under class A1 (the highest class).

Table 1. EN 14961-2 Standard, Class A1

Dimensions (mm)	D08 (8 mm + 1mm, and 3,15 < L < 40 (95%),
Diameter (D) and length (L)	all < 45 mm)
Moisture (w-% as received)	M10 (< 10 w-%)
Ash (w-% dry basis)	A0.7 (< 0,7 w-%)
Mechanical durability	DU97.5
Fines (w-%, < 3.15 mm)	F1.0 (1 w-% at factory gate when loading)
Additives (w-% of pressing mass)	< 1 w-% (starch)
Net calorific value as received	Q4.7 [kWh/kg]
Bulk density (kg/m^3)	600 (> 600 kg/m^3)
Nitrogen (w-% of dry)	N0.3 (< 0,3 w-%)
Sulphur (w-% of dry)	S0.03 (< 0,03 w-%)
Chlorine (w-% of dry)	Cl0.02 (< 0,02 w-%)
Arsenic (mg/kg dry)	< 1 mg/kg
Cadmium (mg/kg dry)	< 0,5 mg/kg
Chromium, (mg/kg dry)	< 10 mg/kg
Copper, (mg/kg dry)	< 10 mg/kg
Lead,(mg/kg dry)	< 10 mg/kg
Nickel (mg/kg dry)	< 10 mg/kg
Mercury (mg/kg dry)	< 0,1 mg/kg
Zinc (mg/kg dry)	< 100 w-%

SAMPLING LOCATIONS

Pellet samples were collected from a total of 12 economic operators involved in wood pellet manufacturing and trade, listed under Table 2. This List, together with corresponding focal point details, was provided by the responsible Project officers in a timely manner and facilitated the sample collection by our team.

Table 2. Enterprises wherefrom wood pellet samples were collected

Enterprise	Contact person	Phone number	Municipality
Thes Ari	Bashkim Zejnullahu	045 321 725	Kllokot
Pell@green	Afrimi Demaj	044 235 435	Kamenica
Dragaj Group	Kujtim & Arsim Dragaj	044 346 353	Mitrovica
K-Berisha	Kastriot Berisha	044 241 662	Prishtina
Green Heat	Argjent Hyseni	049 208 092 044 217 326	Prishtina
Elfa	Elbasan Maliqi	044 500 347	Mitrovica
Biopelleti	Faruk Prebeza	044 509 798	Mitrovica
Importer 1			Prishtina
Jeta –H	Xhevdet Hasanmetaj	044 127 752	Deçan
Evropa	Mladen Miličević	644776095	Mitrovica
Molika	Bastri Sinani	044 502 043	Prishtina
Importer 2			Prishtina

METHODOLOGY

Field sampling and the subsequent transportation of samples to the laboratory was carried out by the technical staff of the laboratory *(except for the samples of imported products which were brought in by project officers).*

Samples which were brought to the laboratory were labelled accordingly (with sample number, name of the company owner and the company, location, etc.), while the samples taken were prepped for laboratory testing in line with international standards and protocols, both ISO and EPA.

Pictures 1 and **2**. Sampling and prepping samples for laboratory testing

Picture 3. Prepping the representative samples for laboratory tests

Picture 4. Measuring samples for determining ash content

Picture 5. Determining moisture content

Picture 6. Determining pellet diameter and length

Picture 7. Determining ash content

Picture 8. Determining heavy metals (AAS spectroscopy)

FINDINGS

The laboratory testing of physicochemical qualitative properties wood pellet samples carried out to determine the wood pellet quality, produced different results depending upon which manufacturer was the sample taken from. The results are presented in details in Tables 3 and 4 below and in Graphs 1 through 10 of this Report.

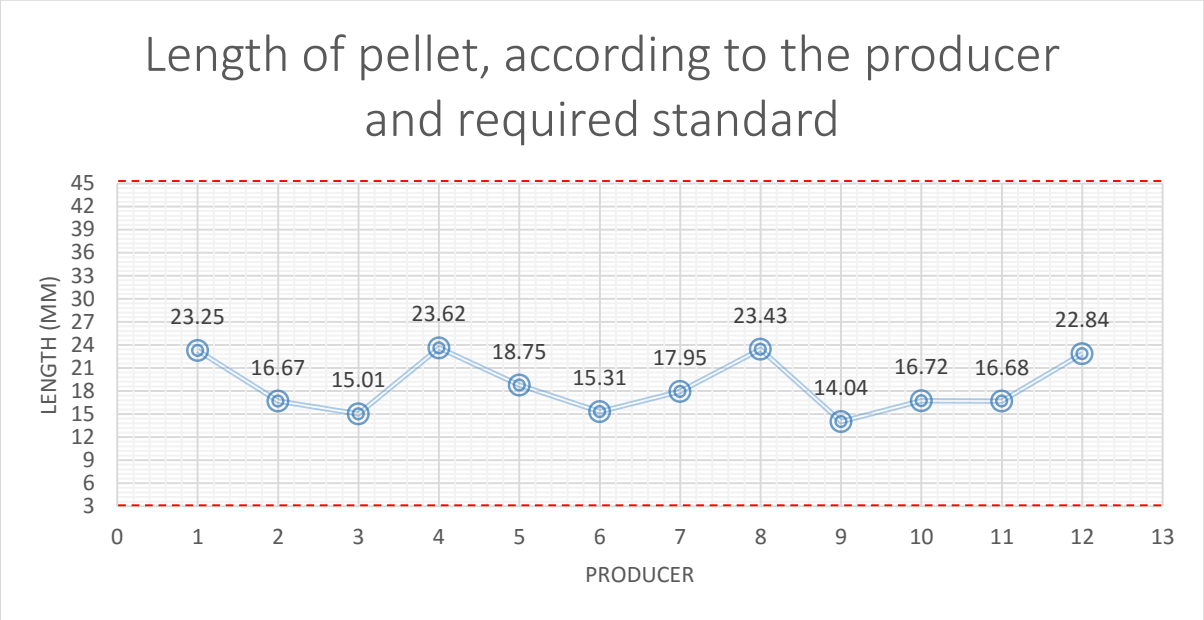
Most results fell within the range of referential norms, with some minor exceptions. The difference was notable in the case of bulk density, where in two cases the values fell below the permitted referential values (in the case of Operator No 7 and Importer No 11, highlighted in red in Table 3). Additionally, the values for other properties were compared to referential values, as shown in Table 3 and 4.

Table 3. Laboratory analyses of pellet samples

MANUFACTURER	PROPERTIES ANALYSED									
	Length [mm]	Quality Class	Diameter [mm]	Quality Class	Density [kg/dm^3]	Quality Class	Moisture [%]	Quality Class	Ash [%]	Quality Class
1	23.25	D0.6	6.10	D0.6	728	DB 700	6.76	M10	0.70	A0.7
2	16.67	D0.6	6.10	D0.6	675	DB 650	8.10	M10	1.62	A1.5
3	15.01	D0.6	6.10	D0.6	648	DB 650	11.11	M10	2.24	A2.0
4	23.62	D0.6	6.10	D0.6	652	DB 650	7.91	M10	1.91	A2.0
5	18.75	D0.6	6.10	D0.6	656	DB 650	9.48	M10	1.37	A1.5
6	15.31	D0.6	6.10	D0.6	624	DB 600	8.52	M10	2.14	A2.0
7	17.95	D0.6	6.10	D0.6	560	DB 550	9.82	M10	2.53	A3.0
8	23.43	D0.6	6.10	D0.6	633	DB 650	8.83	M10	1.63	A2.0
9	14.04	D0.6	6.10	D0.6	694	DB 700	7.60	M10	1.41	A1.5
10 (importer)	16.72	D0.6	6.10	D0.6	612	DB 600	9.26	M10	2.26	A2.0
11 (importer)	16.68	D0.6	6.09	D0.6	566	DB550	10.31	M10	2.49	A2.0
12	22.84	D0.6	6.10	D0.6	650	DB 650	8.69	M10	2.43	A2.0
Standard	**3,15 < L < 40 mm**		**6 (+1) or 8 (+1) mm**		**> 600 kg/m^3**		**< 10 w-% wet basis**		**< 3.0 w-% dry basis**	

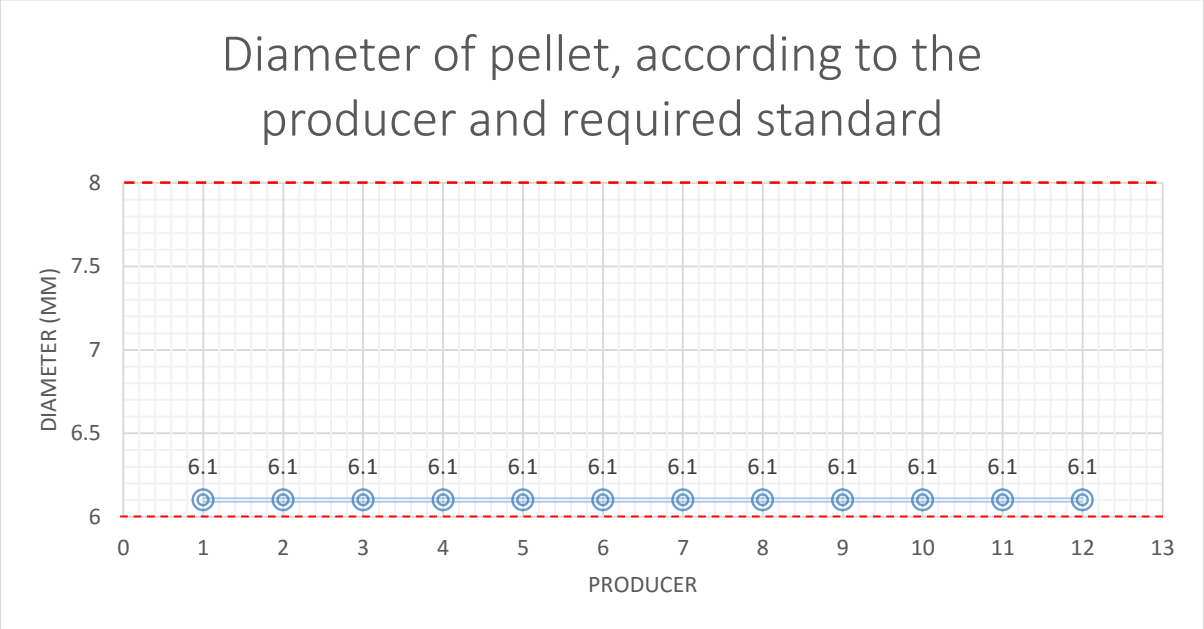
Table 4. Laboratory analyses of pellet samples

MANUFACTURER	PROPERTIES ANALYSED									
	Sulphur [%]	Quality Class	Chlorine [%]	Quality Class	Nitrogen [%]	Quality Class	Lead [mg/kg]	Quality Class	Cadmium [mg/kg]	Quality Class
1	0.07	S0.08	0.020	Cl0.02	0.2	N0.3	0.01	N/A	ND	N/A
2	0.09	S0.08	0.045	Cl0.03	0.2	N0.3	0.25	N/A	0.010	N/A
3	0.03	S0.02	0.012	Cl0.02	0.6	N0.5	0.13	N/A	ND	N/A
4	0.02	S0.02	0.047	Cl0.03	0.5	N0.5	0.67	N/A	0.046	N/A
5	0.02	S0.02	0.026	Cl0.03	0.1	N0.3	0.09	N/A	ND	N/A
6	0.05	S0.05	0.055	Cl0.07	0.8	N1.0	0.05	N/A	0.012	N/A
7	0.08	S0.08	0.041	Cl0.03	0.1	N0.3	0.17	N/A	0.001	N/A
8	0.03	S0.02	0.022	Cl0.02	0.6	N0.5	0.02	N/A	ND	N/A
9	0.05	S0.05	0.017	Cl0.02	0.4	N0.3	2.95	N/A	0.008	N/A
10 (importer)	0.09	S0.08	0.043	Cl0.03	0.9	N1.0	0.04	N/A	ND	N/A
11 (importer)	0.08	S0.08	0.019	Cl0.02	0.4	N0.3	0.21	N/A	0.002	N/A
12	0.05	S0.05	0.052	Cl0.07	0.6	N0.5	0.26	N/A	ND	N/A
Standard	**< 0.04 w-% dry basis**		**< 0.03 w-% dry basis**		**< 1.0 w-% dry basis**		**< 10.0 mg/kg dry basis**		**< 0.5 mg/kg dry basis**	



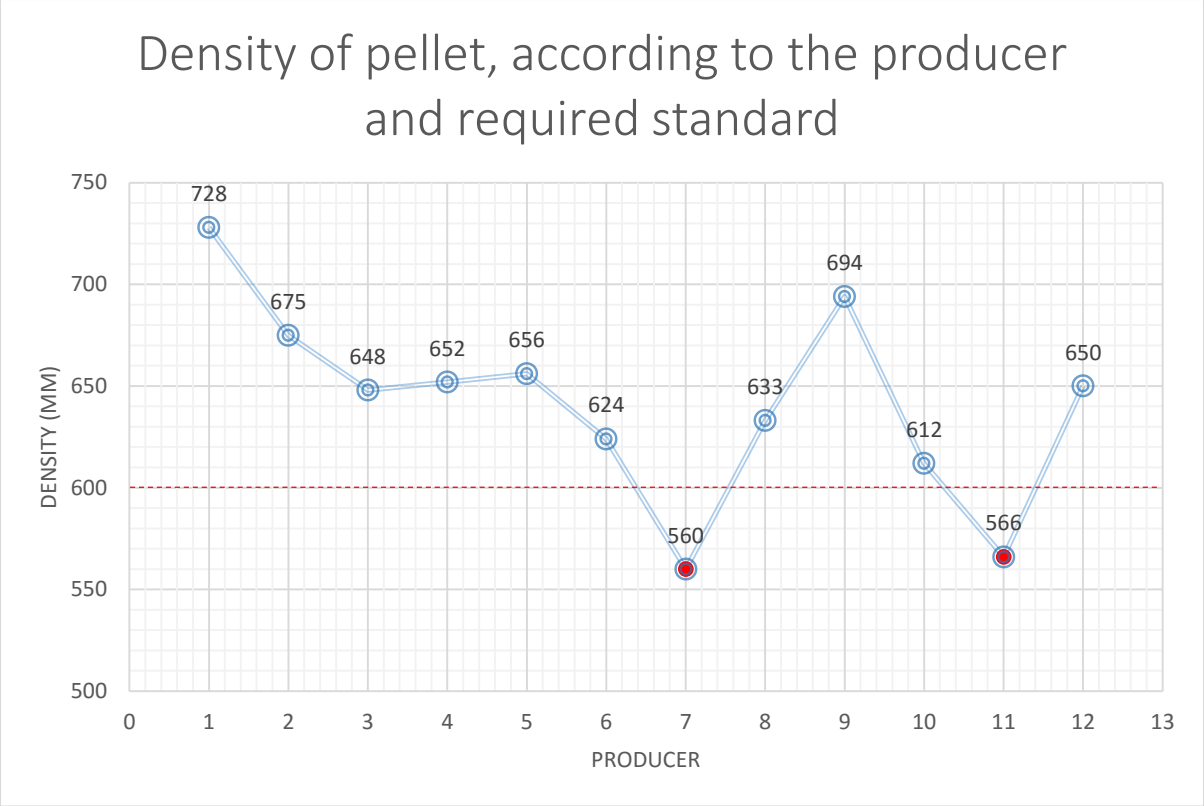
Graph 1. Pellet length by manufacturer and the required standard

With regard to pellet length, all samples tested, from all manufacturers, were within the permitted values according to European standards and pellet categorisation under A1, A2 and B Classes respectively, providing that pellets are between 3.15 mm and 45 mm in length.



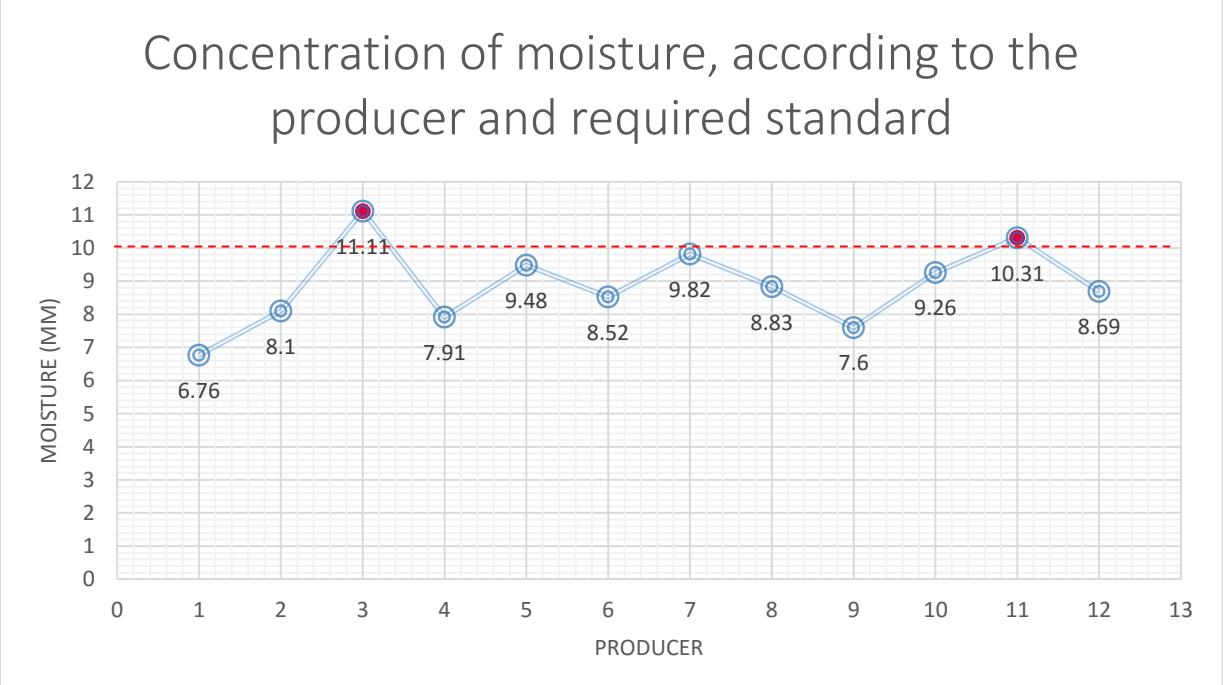
Graph 2. Pellet diameter by manufacturer and the required standard

Pursuant to the standards in place for pellet classes A1, A2 and B, pellet diameter should be between 6.0 ± 1mm and 8.0 ± 1 mm, and the tested samples from all manufacturers fell within the required standard, 6.1 mm to be more exact.



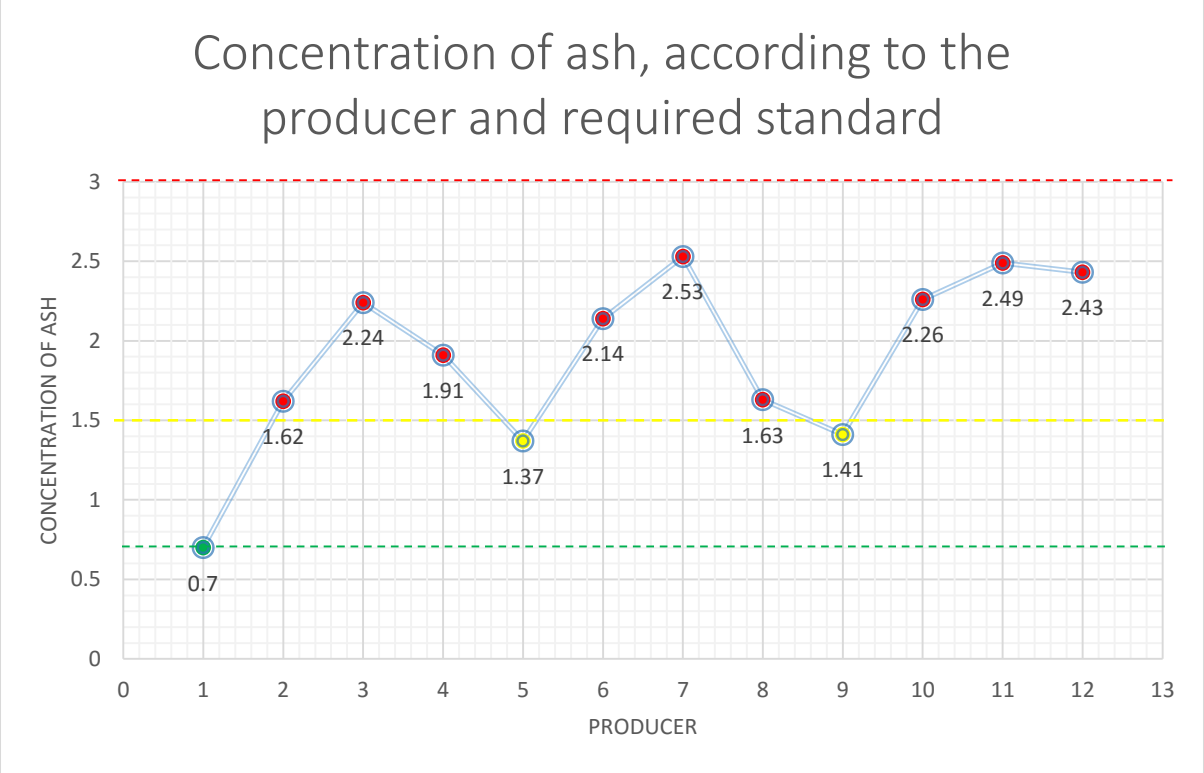
Graph 3. Pellet density by manufacturer and the required standard

As regards density (Bulk density), the tests of samples also produced results that fall within the requirements for A1, A2 and B classes, except for samples taken from Manufacturers No. 7 and 11 (Importer) where parameter values fell below the abovementioned standards (< 600 kg/dm^3), 560 and 566 kg/dm^3 respectively.



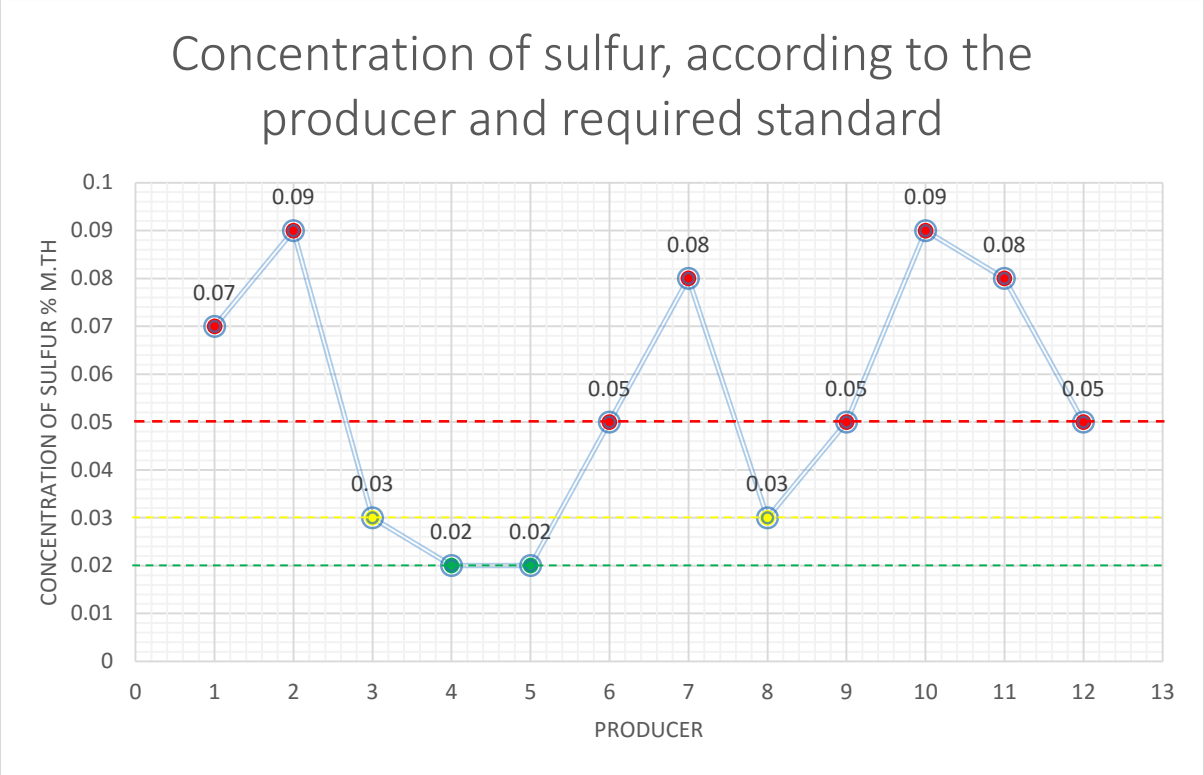
Graph 4. Moisture content by manufacturer and the required standard

Moisture content, as a physical property, was also within the standards in place A1, A2 and B Classes, except for the pellet sample obtained from Manufacturer No. 3 and 11 (Importer) where the resulting values were slightly higher than the permitted maximum of 10%, specifically 11.11% in the case of Manufacturer No 3 and 10.31% in the case of No 11 (Importer).



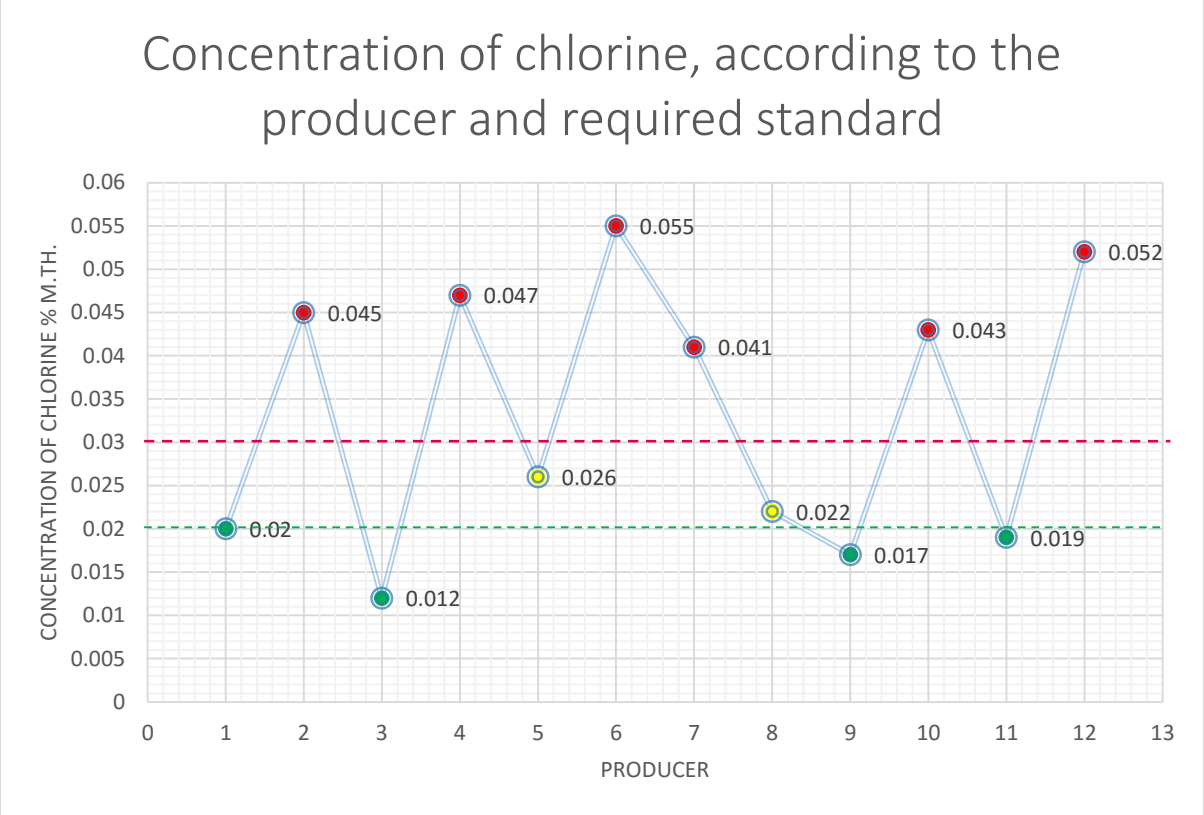
Graph 5. Ash content by manufacturer and the required standard

Ash content in tested samples was characterized with quite significant vaiability, with values that fell bellow the required standard of 0.05%, where standards for max A1 reach the value 0.7%, max A 1.50%, and max B 3.00%.



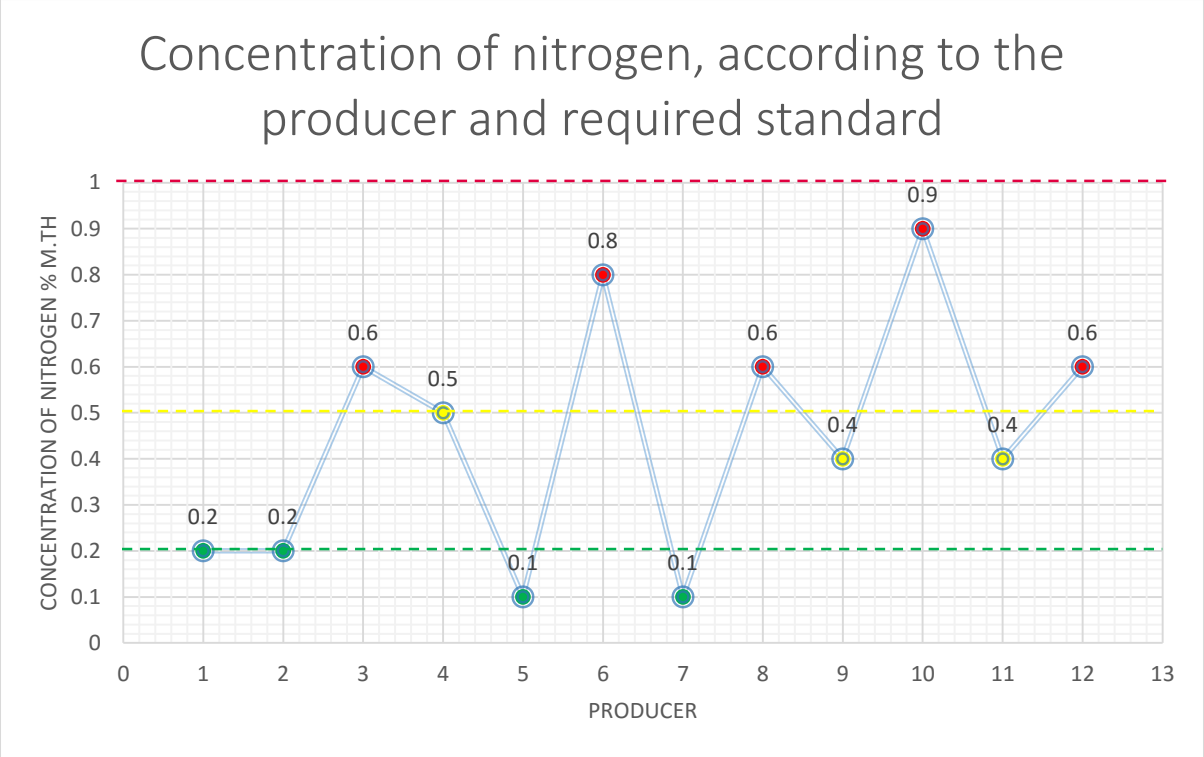
Graph 6. Suplhur content by manufacturer and the required standard

Sulphur content in tested samples showed quite significant variability compared to the required standard of 0.05%. Suplhur content values in the samples taken from Manufacturers No 1, 2 and 7, and Importers 10 and 11 were higher than the permitted maximum for A1, A2 dhe B classes, whereas in the case of other manufacturers fell within the required standard (<0.05%).



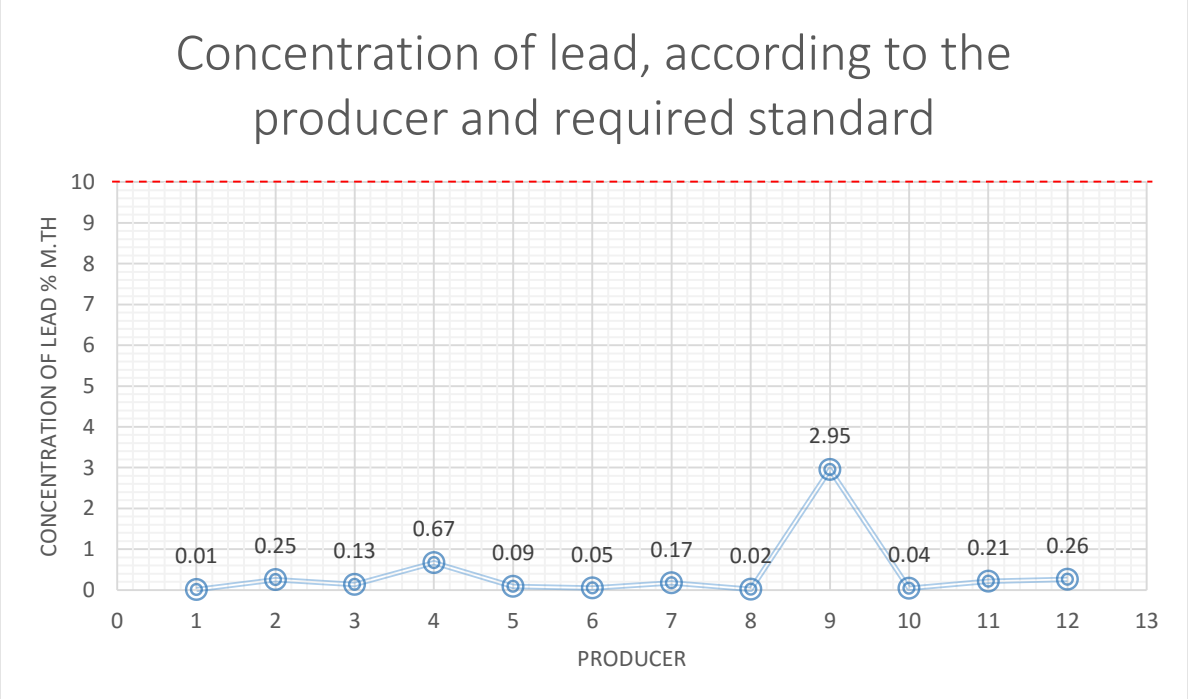
Graph 7. Chlorine content by manufacturer and the required standard

Chlorine content in the samples taken from Manufacturers No 2, 4, 6 and 7, and Importer No 11, and Manufacturer No 12, was higher than the standards in place for class A1 (<0.02), A2 and B (0.03), while in the case of other manufacturers was equal to or below the standard.

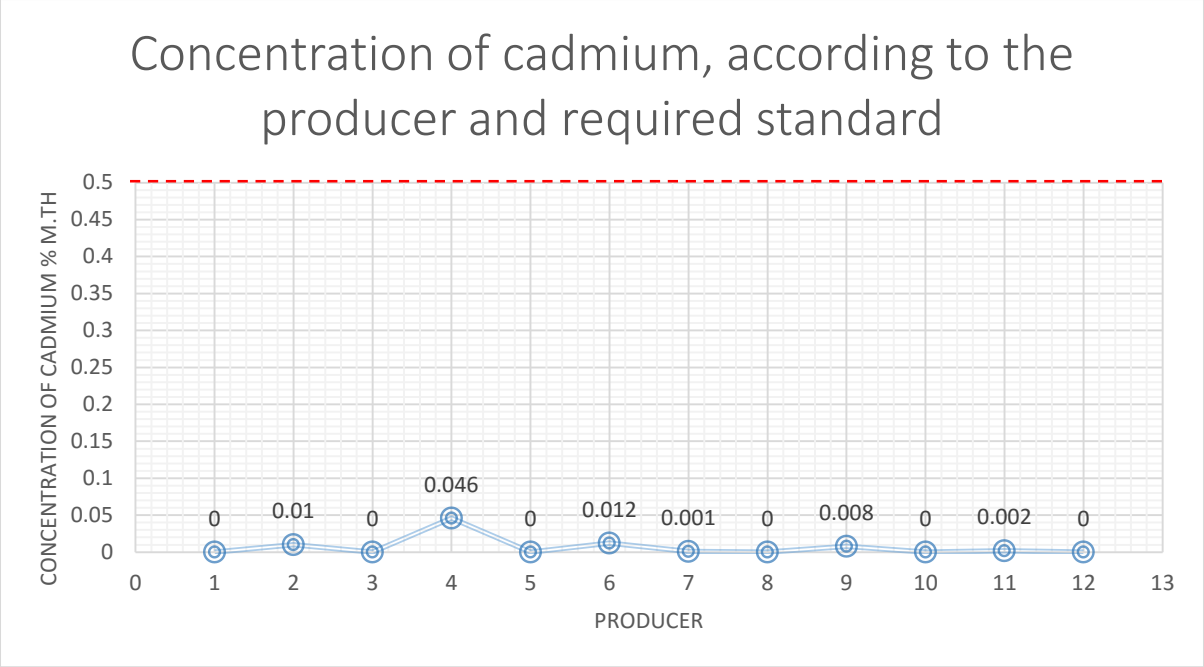


Graph 8. Nitrogen content by manufacturer and the required standard

Nitrogen, lead and cadmium content also featured quite significant variability in samples obtained from various manufacturers, however, the values obtained were nevertheless lower than the referential values provided for the standards under class **A1** (<0.3), **A2** (<0.5) and **B** (<1.00) (See Graphs 8, 9 and 10).



Graph 9. Lead content by manufacturer and the required standard max A1, A2 and B (<10.00)



Graph 10. Cadmium content by manufacturer and the required standard max A1, A2 and B (<0.50)

CONCLUSIONS

Based on laboratory tests carried out and the results obtained therefrom, the following can be concluded:

- Significant amounts of wood pellet are being traded in the recent years in Kosovo in response to needs of consumers for use for heating.
- Wood pellet samples were collected from 12 economic operators with a view to determine its quality.
- The physicochemical properties analysed fall within the requirement laid down in the Normative [sic.] EN 14961-1, with some minor exceptions.
- An exception from the standard was identified for bulk density in the case of Operators No 7 and 11 (Importer), where the values fell below the requirement of 600 kg/dm^3, with 560 and 566 kg/dm^3 respectively.
- Values obtained for other physicochemical properties fell within the requirements laid down under the EN 14961-1 standard, but under different classes.
- The values for heavy metals (Pb and Cd) were lower than the referential values laid down under the EN 14961-1 standard.
- In order to attain higher standards in wood pellet manufacturing, it is recommended that economic operators are continuously monitored and are provided continuous institutional support.