



Wood pellet quality with respect to EN 14961-2 standard and certifications



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HIGHLIGHTS

- The assessment of the quality of wood pellet sold in the market has been carried out.
- The relationship between information reported on bag and pellet quality was evaluated.
- More than half of samples fulfill EN 14961-2 A1 quality class requirements.
- Certification is appropriated to guarantee for a high quality of pellet sold in the market.
- Ash content alone is a representative parameter for a rapid assessment of pellet quality.

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ABSTRACT

Wood pellet production has increased hugely in recent years from 7 to 19 million tons in the period 2006–2012, mainly due to the demand created by policies and bioenergy use targets in Europe. Italy is one of the most important importers for domestic heating application and the Italian market can be considered a good subject to estimate the efficacy of quality standards and certification application. The assessment of the quality of wood pellet sold in the market and how the information reported on bag reflect the quality of the product has been carried out during a three-year period. Characterisation analyses and collection of data regarding information reported on bags such as characterisation results, ash class, wood species, certifications, and standard references have been carried out. Results have been statistically evaluated. More than half of samples fulfill the requirements of the A1 class of EN 14961-2 standard, related to the higher quality pellets. Certification, like ENplus and DINplus, appears to be appropriated to guarantee for a high quality of pellet sold in the market. Ash content alone could be a good representative parameter for a first, rapid quality assessment. Ash content results significantly lower in coniferous pellet than in broadleaf one.

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1. Introduction

In recent years biomass has become the most important renewable source for heat generation.

Across European countries, biomass residential heating technology differs from simple and cheap in Sweden and France to sophisticated and expensive in Germany and Austria as far as pellet boilers are concerned [1]. Wood pellet production in particular has increased dramatically in recent years, mainly due to the demand created by policies and bioenergy use targets in Europe aiming to reduce carbon dioxide emissions into the atmosphere by means of a substitution of fossil fuels with renewable ones. The pelletisation of biomass involves the mass and energy densifi-

cation of materials that possess low bulk densities such as sawdust, straw, and other herbaceous biomass. This process reduces transportation costs, and provides better handling and feeding of the biomass with less dust formation [2,3].

The world production of wood pellet doubled from 2006 to 2010 reaching 14 million tons in 2010 [4]. In 2012 FAO has started collecting global statistics on production and trade of wood pellets and has just produced the first global estimate. This shows that global production of wood pellets were 19 million tonnes in 2012 [5] with Europe and North America accounting for almost all global production and consumption. The EU-27 is the largest global producer of wood pellets, its output reaching an estimated 10.5 million tonnes in 2012; production in the EU-27 rose by 57% overall between 2009 and 2012. The EU-27 is also a net importer of wood pellets: the level of imports from non-member countries rose to 4.5 million tonnes by 2012, which was an overall increase of

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158% in relation to 2009 [6]. The EU pellet consumption for heating has grown by more than one million tons per year since 2010, amounting to 8 million tons in 2012 [7].

In several European countries such as Germany, Austria, Sweden, Finland, Italy, Switzerland and France, wood pellet heating technology is mature enough to compete successfully with traditional fossil fuel heating devices. There are marked differences in the markets for these countries and some of them have further important margins of growth [8]. Italy is one of the most important European pellet market for domestic heating use with about 2 million tonnes consumption.

In general, the raising pellet demand by the domestic heating sector, together with limited availability of raw material, drive the market from local to global context with an increase of international trade. Italy is one of the most important importers with 1.2 million tonnes of pellet yearly. For a correct growth of pellet market, clear quality and sustainability requirements and certifications, combined with additional measurements and tools on a regional, national and international level are needed [9]. High solid biofuel quality is in fact required by pellet devices in order to obtain high efficiency and low emissions.

In general, the chemical, mechanical, and physical properties of biomass affects pellet quality in terms of thermal utilization. Some of these parameters are related to the raw materials used, whereas others are related to the quality management of the manufacturing process [10–13].

End-consumers are mainly concerned with the energy content of the pellets, the emissions generated by pellet combustion and the effects of the use of pellets in boilers and stoves. Emissions and low-quality solid biofuels can damage combustion equipments and produce slagging, corrosion, and poor process control [13]. Furthermore, the content of fine particles in the fuel, which is extremely dependent on mechanical durability as well as logistics and storage issues, can disturb the regulation of automated heating systems or interrupt automated fuel feeding [14]. In addition, fine particles burn more quickly, and these higher temperatures can favor ash-melting.

Many European countries have developed standards for the quality, storage, transport and combustion of densified biomass fuels as reported by some authors [10]. In 2012 the European wood pellets standard EN 14961-2 [15] has been published to harmonize the market and an international ISO standard ISO 17225-2 will be published probably in Spring 2014 and it will supersede EN ISO 14961-2 in Europe. Standard includes parameters and threshold values for dimensions (length and diameter), fines, mechanical durability, ash content, net calorific value as received and chemical composition.

Certification systems have been based upon these quality standards and take also into account all the chain of custody from the raw material production to the pellet end user. The most widespread pellet certifications are ENplus and DINplus based on EN 14961-2 technical standard “Fuel specification and classes standards for wood pellets for non-industrial use”. According to AEBIOM [7] 4 million tons of pellet for heating in 2012 are ENplus certified.

The increasing adoption of biomass fuel pellets is largely driven by policy and financial incentives in much of the world, particularly in Europe. Incentives come with different forms, such as tax exemptions, certificates, renewable obligations, subsidies for pellet heating systems installation. [16].

In Italy to promote renewable energies there are measures favoring in general energy efficiency and specific tax deductions in case of substitutions of heating system fueled with fossil fuels with other fueled with renewable ones. Moreover, on the basis of the quality of solid biofuel consumed, users owning certain types of domestic heating appliances may receive incentives. In particu-

lar, the pellet must be certified by an accredited body for the compliance with the EN 14961-2 class A1 or A2 [17]. In addition, some Italian regional governments have prohibited in certain municipalities, the use of pellets of different quality from the A1 and A2 [18].

The quality of certified pellet is constantly monitored through unannounced inspections and performed by inspection bodies according to ISO/IEC 17020: (Conformity assessment – Requirements for the operation of various types of bodies performing inspection) and independent analysis conducted by accredited laboratories according to ISO/IEC 17025 (General requirements for the competence of testing and calibration laboratories).

However, in the market it is possible to find wood pellet which properties and characteristics are defined in different way: no references, reference to a quality standard, reference to a certification system. In literature there are no specific studies on the real quality of pellet sold in the market and the relationship with standards and certifications references.

For this reason, the authors of this paper have been stimulated to assess the quality of wood pellet in the market and how the information reported on the bag reflect the quality of the product. This research is based on an extensive database of characterisation analysis carried out on several samples taken from the market in the last three years. In a previous study carried out on data related to the first two years the author evaluated relationships among the analytical parameters [19]. Considering the large amounts of data now available the authors have evaluated relationships between analytical parameters and information found on pellet bags. The quantity of data can give a good estimation about the effectiveness of standards and certifications.

2. Materials and methods

For the purposes of this research 130 pellet bags were purchased directly from 58 points of sale distributed in different Italian regions during the period between November 2010 and December 2013. The choice of points of sale did not follow any criteria and neither the seller nor the manufacturer were informed about the research. A sample corresponding to each pellet bag has been analyzed in the Biomass Lab of the D3A Department of Università Politecnica delle Marche following EN 14961-2 standard. This standard defines three quality classes: A1, A2 and B based on range values of some parameters, with ash content as the most discriminating one.

The physical and chemical parameters taken into account in this study are shown in Table 1 and the methods and equipments employed are reported in the following paragraph.

Further information on the labels found on the bags and other declarations by producers or traders, as well as the results of the laboratory analysis have been recorded. Among them EN quality class (A1, A2 and B), wood species, physical and chemical parameters values, standards and certifications references have been considered. An example of some information found on bags is reported in Fig. 1.

2.1. Methods and equipments

Moisture content (M) was determined according to EN 14774-2 using a forced ventilation oven (mod. M120-VF, MPM Instruments).

The determination of ash content (A) was carried out according to EN 14775 using a muffle furnace (mod. ZA, Prederi Vittorio & figli).

Mechanical durability (DU) was analyzed by means of a mechanical durability tester (Andritz Sprout rotation pellet testing apparatus) according to EN 15210-1.

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