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Maize (*Zea mays* L.) — Specification

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Contents

page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Specifications	4
4.1 General characteristics and sensory properties	4
4.2 Health characteristics	4
4.3 Physical and chemical characteristics	4
5 Sampling	5
6 Test methods	5
Annex A(Informative) Indicative list of harmful and toxic seeds	6
Annex B (Informative) Unacceptable mites and insect pests of stored cereals	8
Annex C (Normative) Determination of impurities	10
Annex D (Informative) Diagram of procedure	14
Bibliography	13

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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ISO 19942 was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 4, *Cereals and pulses*.

Maize (*Zea mays* L.) — Specification

1 Scope

This international Standard lays down minimum specifications for maize (*Zea mays* L.) intended for human consumption and animal feed and which is the subject of international trade.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 5223, Test sieves for cereals.

ISO 6540, Maize -- Determination of moisture content (on milled grains and on whole grains).

ISO 6639-3, Cereals and pulses — Determination of hidden insect infestation — Part 3: Reference method.

ISO 6639-4, Cereals and pulses — Determination of hidden insect infestation — Part 4: Rapid methods.

ISO 7971-1, Cereals — Determination of bulk density, called "mass per hectolitre" — Part 1: Reference method.

ISO 7971-3, Cereals — Determination of bulk density called "mass per hectolitre" — Part 3: Routine method.

ISO 24333, Cereals and cereal products — Sampling

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1

bulk density

test weight

cereals ratio of the mass of a cereal to the volume it occupies after being poured into a container under well-

defined conditions

Note 1 to entry: Bulk density is expressed in kilograms per hectoliter of grains as received. The other units including grams per liter, pound per bushel could also be used.

3.2

impurities

Besatz

all the elements which are conventionally considered as undesirable in a sample or batch of maize grains

[SOURCE: ISO 5527:1995^[1],1.4]

Note 1 to entry: In maize, impurities comprise four main categories: broken grains, damaged grains, other grains, miscellaneous impurities.

Note 2 to entry: Live pests are not considered as impurities. They are specified as separate criterion.

3.3

broken grains

grains or pieces of grains which pass through a sieve with a circular mesh of 4,5 mm in diameter specified in ISO 5223

3.4

damaged grains

whole kernel which is immature, distinctly discolored, sprouted, diseased or damaged by weather, pest, heat, or any other causes which are not unsound grains (3.6.2) but still fit for human and/or animal consumption

3.4.1

heat-damaged grains

resulting from the effect of heat, grain with a chestnut to black coloration, and of which a section of the endosperm is yellowish-grey or brownish black resulting from the effect of spontaneous heat generation or too extreme heating during drying

3.4.2

sprouted grains

grains in which the radicle or plumule is clearly visible to the naked eye

Note 1 to entry: Account should be taken of the general appearance of the sample when its content of sprouted grains is assessed.

Note 2 to entry: Sprouted grains are only those where the germ has undergone clearly visible changes which makes it easy to distinguish the sprouted grain from the normal grain

3.4.3

grains attacked by pests

grains which show visible damage owing to attack by insects, rodents, mites or other pests

3.4.4

Immature grains

Shrunken grains

grains which are unripe and/or badly developed, poorly filled, thin and light or papery in appearance, whose build-up of reserves has been halted due to physiological or pathological factors

3.5

other grains

grains other than maize, in any condition

3.6

miscellaneous impurities

elements consisting of extraneous seeds, unsound grains, extraneous matter and impurities of animal origin

3.6.1

extraneous seeds

seeds of plants, whether or not cultivated, other than cereals. They include seeds not worth recovering, seeds which can be used for livestock but which are not cereals, and noxious seeds

Note 1 to entry: "Noxious seeds" means seeds which are toxic to humans and animals, seeds hampering or complicating the cleaning and milling of cereals and seeds affecting the quality of products processed from cereals

3.6.2

unsound grains

diseased grains

grains rendered unfit for human and/or animal consumption, owing to putrefaction, mildew, grain affected with fusariosis, or bacterial or other causes

Note 1 to entry: Unsound grains also include grains damaged by spontaneous heat generation or too extreme heating during drying which are fully grown grains in which the tegument is coloured greyish-brown to black while the cross-section of the kernel is coloured-yellowish grey to brownish-black.

3.6.3

extraneous matter

all matters in a sample that passing through a sieve with apertures of 1.0 mm specified in ISO 5223, and also includes stones, sand, fragments of straw, cob and similar impurities in the samples which are retained by a sieve with apertures of 1,0 mm

Note 1 to entry: with the exception of live and dead insects

3.6.4

impurities of animals origin

Impurities originating from animals such as feathers, hairs, excrements, dead insects and fragment of insects

4 Specifications

4.1 General characteristics and sensory properties

Maize grains shall be sound, clean and have no foreign odours or odours denoting any deterioration.

4.2 Health characteristics

4.2.1 Maize grains shall be free from intentionally added substance and heavy metals in amounts which may represent a hazard to human and/or animal health. Maize shall not contain mycotoxins, pesticides residues or other contaminants at levels (or concentration) which can affect human and/or animal health. The maximum levels authorized are laid down by the national or regional regulation, or the joint FAO/WHO Codex Alimentarius Commission (see References [5] to [9]).

4.2.2 Maize shall be free from the living insects (listed in annex B), when determined according to part 3 or 4 of ISO 6639, and of mites when determined by the sieving method which are clearly visible to the naked eye

4.3 Physical and chemical characteristics

4.3.1 Moisture content

The moisture content of maize, determined in accordance with ISO 6540, shall not be greater than 14.5 % (mass fraction).

NOTE 1: Different moisture contents are required for certain destinations, in relation to the climate, and duration of transport and storage. For further information, see ISO 6322, parts 1, 2 and 3.

4.3.2 Bulk density

The bulk density, called "mass per hectoliter", of maize shall be determined using instruments calibrated according to the reference method given in ISO 7971-1 or, by default, according to the routine method given in ISO 7971-3, and shall not be less than 60 kg/hl.

4.3.3 Impurities

The maximum impurities content, determined using the method described in Annex C and D, shall not exceed the value given in Table 1.

The maximum content of the impurities (broken grains, damaged grains, other grains and miscellaneous impurities), shall not exceed 15 % and 20% (mass fraction) for human food and animal food, respectively in total.

Table 1 — Maximum levels of impurities

Impurities	Definition given in	Maximum permissible level % (mass fraction)	
		human food	animal food

broken grains	3.3	6,0	10,0
damaged grains	3.4	10,0	15,0
miscellaneous impurities	3.6	1,0	2,0
extraneous matter	3.6.3	1,0	1,0
impurities of animals origin	3.6.4	0,1	0,1
<p>Note The maximum content of the impurities (broken grains, damaged grains, other cereals and miscellaneous impurities), shall not exceed 15 % (mass fraction) and 20% (mass fraction) for human food and animal food, respectively in total.</p>			

5 Sampling

Sampling shall be carried out in accordance with ISO 24333.

6 Test methods

The test methods shall be carried out using the methods specified in clause 4.3, Annex C and Annex D.

7 Transportation

Maize shall be transported with facility free of living pests and shall be protected from water and contaminant of toxic or harmful substance.

Annex A (Informative)

Indicative list of harmful and toxic seeds

WARNING — This is a non-exhaustive list which could be completed if the necessity arose.

A.1 Toxic seeds

Botanical name	Common name
<i>Acroptilon repens</i> (L.) DC.	
<i>Agrostemma githago</i> L.	Corn-cockle
<i>Coronilla varia</i> L.	Coronilla, Crown vetch
<i>Crotalaria</i> spp.	Crotalaria
<i>Datura fastuosa</i> L.	Jimson weed
<i>Datura stramonium</i> L.	Stramony, thorn apple
<i>Heliotropium lasiocarpum</i> Fisher et C.A.	Meyer Heliotrope
<i>Lolium temulentum</i> L.	Darnel
<i>Ricinus communis</i> L.	Castor-oil plant
<i>Sophora alopecuroides</i> L.	Stagger bush, Russian centaury
<i>Sophora pachycarpa</i> Schrank ex C.A. Meyer	
<i>Thermopsis montana</i>	Buffalo pen
<i>Thermopsis lanceolata</i> R. Br. in Aiton	
<i>Trichoderma incanum</i>	

A.2 Harmful seeds

Botanical name	Common name
<i>Allium sativum</i> L.	Garlic
<i>Cephalaria syriaca</i> (L.)	Roemer et Shultes Teasel
<i>Melampyrum arvense</i> L.	Cow-cockle

Melilotus spp.

Melilot

Sorghum halepense (L.)

Pers. Johnson grass

Trogonella foenum-graecum L.

Fenugreek

Annex B

(Informative)

Unacceptable mites and insect pests of stored cereals

The following are unacceptable in stored cereals:

Ahasverus advena (Waltl)

Attagenus brunneus (Faldermann)

Attagenus unicolor japonicus (Reitter)

Corcyra cephalonica (Stainton)

Cryptolestes ferrugineus (Stephens)

Cryptolestes pusillus (Schönherr)

Cryptolestes turcicus (Grouville)

Ephestia cautella (Walker)

Ephestia kiihniella (Zeller)

Latheticus oryzae (Waterhouse)

Liposcelis bostrychophila (Badonnel)

Nemapogon granella (L.)

Oryzaephilus mercator (Fauvel)

Oryzaephilus surinamensis (Linnaeus)

Plodia interpunctella (Hübner)

Prostephanus trurtcatus (Hom)

Rhizopertha dominica (Fabricius)

Sitotroga cerealella (Olivier)

Sitophilus granarius (Linnaeus)

Sitophilus oryzae (Linnaeus)

Sitophilus zeamais (Motschulsky)

Tenebroides mauritanicus (Linnaeus)

Tribolium castaneum (Herbst)

Tribolium confusum (Jacquelin du Val)

Trogoderma granarium (Everts)

Trogoderma variabile (Ballion)

Tyroglyphus ovatus (Troupeau)

Tyrophagus putrescentiae (Schrank)

Annex C (Normative) Determination of impurities

C.1 Principle

The principle of this method is to separate all the groups of impurities defined in 3, from the normal basic grains by sieving and manual selection.

C.2 Apparatus and equipment

C.2.1 Sample divider.

C.2.2 Balance, with a reading accuracy of 0,001 g and capable of weighing to the nearest 0,01 g.

C.2.3 Sieves, with circular hole of 4,5 mm in diameter and slot-widths 1,0 mm × 20,0 mm, in accordance with the specifications of ISO 5223.

C.2.4 Sieving machine, having a rectilinear movement of go and come in the sense of the rectangular holes.

C.2.5 Magnifying glass, illuminated.

C.2.6 Forceps or horn spatula.

C.2.7 Pots, for retaining components.

C.3 Sampling

It is important that the laboratory receives a sample which is truly representative and has not been damaged or changed during transport and storage.

Sampling is not part of the method specified in this International Standard. For information, a recommended sampling procedure is given in ISO 24333 for the sampling of cereals with constituents distributed uniformly or not uniformly.

C.4 Procedure

Prepare by division a representative sample of at least (but near) 500 g for maize. Weigh it to the nearest 0,1 g (a). Pass the sample through the slotted sieve with an aperture of 1,0 mm (C.2.3), for half a minute. For constant sieving, a sieving machine (C.2.4) is recommended. If sieving is performed by hand, it shall consist of horizontal movements parallel to the length of the slots.

The matter passed through the 1,0 mm sieve shall be regarded as extraneous matter. Stones, mud balls, straws, chaff, cob fragments and similar impurities from the over tail of the 1.0 mm slotted sieve have to be picked out. Both fractions are combined and are regarded as extraneous matter (3.6.3). Weigh them to the nearest 0,1 g (b). Impurities of animal origin should be counted (n), including those which passed through the sieve of 1,0 mm slot-width (C.2.3). If necessary, a magnifying glass should be used.

The count of impurities of animal origin (3.6.4) should be quoted separately in numbers per kilogram of maize, as appropriate.

From the over tails of the 1,0 mm sieve (C.2.3), prepare, with the aid of a sample divider, a test sample, between 100 g and 200 g. Weight this test sample to the nearest 0,01 g (c).

Subsequently spread out this partial sample in a thin layer on a table, and pick out by means of forceps or a horn spatula the element constituting the groups of impurities: other cereals (3.5), damaged grains (3.4), and miscellaneous impurities (3.6).

Grains whose tegument shows abnormal colour shall be cut longitudinally through the germ. If a major part or the totality of the section of the germ is identical or darker than the two halves of the initial grain have to be accounted as heat-damaged grains (3.4.1).

In the case of multiple kinds of damages are observed, the damaged grain shall be added to the fraction with the highest importance for the overall quality.

Subsequently sieve the same partial sample through a sieve of 4.5 mm circular holes in diameter for half a minute. The through of this sieve belong to the group broken grains (3.3).

Weigh the clean sample material (d) and all the groups of impurities to the nearest 0,01 g. If, for a partial sample, the sum of weights for broken grains (3.3), damaged grains (3.4), heat-damaged grains (3.4.1), other cereals (3.5), extraneous seeds (3.6.1), extraneous matters (3.6.3) and the weight of the impurities-free overtails of the 1,0 mm sieve (d) differs by more than 1 % from (c), the determination shall be invalid and a new partial sample shall be analysed.

C.5 Expression of results

The mass fraction in percent of the impurity fractions (3.3, 3.4.1, 3.4.2, 3.4.3, 3.5, 3.6.1 and 3.6.2) are calculated as follows:

$$B = x \times \frac{a - b}{c} \times \frac{100}{a}$$

where

B is the mass fraction of impurity fractions (%);

x is the weight of the impurity group concerned (g);

a is the weight of the average sample (g);

b is the weight of the extraneous matter on average sample (g);

c is the weight of subsample from which impurity will be removed (g).

The mass fraction in percent of extraneous matter (3.6.3) is calculated as follows:

$$A = \left(\left(x_8 \times \frac{a - b}{c} \right) + b \right) \times \frac{100}{a}$$

where

A is the percentage of extraneous matter (%);

X₈ is the weight of extraneous matter of subsample from which impurity was removed (g);

a is the weight of the average sample (g);

b is the weight of the extraneous matter of average sample (g);

c is the weight of subsample from which impurity will be removed (g).

The percentage of damaged grains (3.4) is calculated by adding percentages of heat-damaged grains (3.4.1), sprouted grains (3.4.2), and grains attacked by pests (3.4.3).

The percentage of miscellaneous impurities (3.6) is calculated by adding percentages of extraneous seeds (3.6.1), unsound grains (3.6.2) and extraneous matters (3.6.3) and impurities of animal's origin (3.6.4).

The calculation should be carried out to the nearest 0,01 %.

In the investigation report, quote to a precision of 0,1 % for total impurities (3.2), broken grains (3.3), damaged grains (3.4), other cereals (3.5) and miscellaneous impurities (3.6) and to a precision of 0,01 % for all sub components of these categories. Report the impurities of animal origin (3.6.4) in number per kilogram of grain.

C.6 Test report

The test report shall specify:

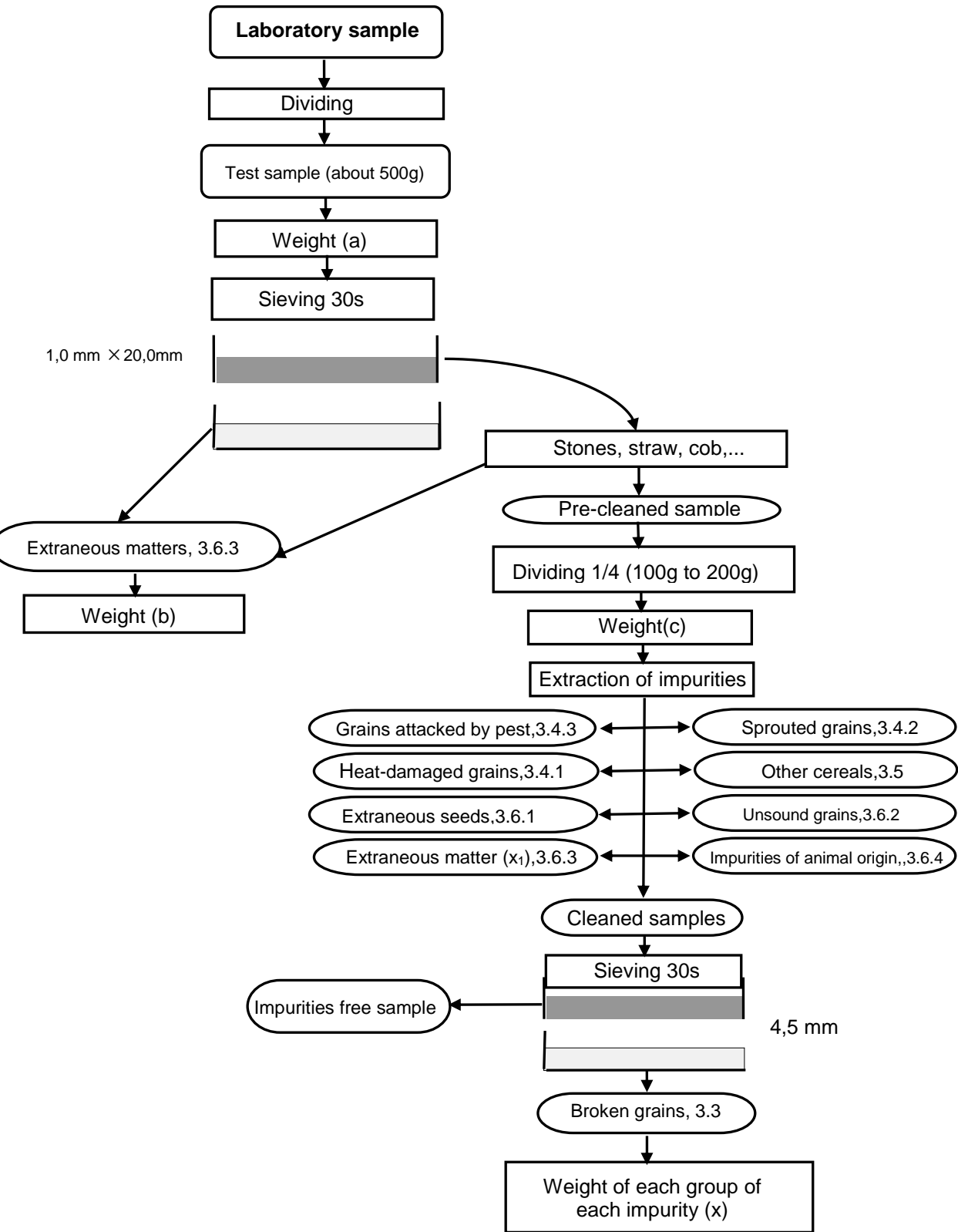
- a) all information necessary for the complete identification of the sample;
- b) the sampling method used, if known;
- c) the test method used, together with the reference to this international Standard;
- d) all operating details not specified in this international Standard, or regarded as optional, together with details
of any incidents which may have influenced the test results;
- e) the test results obtained, and, if the repeatability has been checked, the final quoted result obtained.

EXAMPLE The test results obtained can be reported as follows:

- 1) Bulk density (3.1) XX kg/hl or XX g/L or lb/bu
- 2) Broken grains (3.3) X,X %
- 3) Damaged grains (3.4) X,X %
 - i) Heat damaged grains (3.4.1) X,XX %
 - ii) Sprouted grains (3.4.2) X,XX %
 - iii) Grains attacked by pest (3.4.3) X,XX %
- 4) Other cereals (3.5) X,X %
- 5) Miscellaneous impurities (3.6) X,X %
 - i) Extraneous seeds (3.6.1) X,XX %
 - ii) Unsound grains (3.6.2) X,XX %

- iii) Extraneous matter (3.6.3) X,XX %
- IV) Impurities of animals origin (3.6.4) number/kg
- 6) Total impurities (3.2) X,X %

Annex D (Informative) Diagram of procedure



Bibliography

- [1] ISO 5527:1995, *Cereals - Vocabulary*
- [2] ISO 6322-1, *Storage of cereals and pulses — Part 1: General considerations in keeping cereals.*
- [3] ISO 6322-2, *Storage of cereals and pulses — Part 2: Practical recommendations.*
- [4] ISO 6322-3, *Storage of cereals and pulses — Part 3: Control of attack by pests.*
- [5] CODEX STAN 193-1995, *Codex general standard for contaminants and toxins in food and feed.* Available at: http://www.codexalimentarius.org/download/standards/17/CXS_193e.pdf
- [6] CAC/MISC 6:2015, *List of Codex specifications for food additives.* Available at: <http://www.fao.org/fao-who-codexalimentarius/standards/list-standards/en/>
- [7] CAC/MRL 1:2009, *Maximum residue limits for pesticides.* Available at: <http://www.codexalimentarius.org/standards/pesticide-mrls/en/>
- [8] CAC/MRL 3:2009, *Extraneous Maximum Residue Limits (EMRLs).* Available at: <http://www.codexalimentarius.net/pestres/data/index.html>
- [9] CAC/RCP 54:2004, *Code of practice on food animal feeding.* Available at: <http://www.fao.org/fao-who-codexalimentarius/standards/list-standards/en/>
- [10] EN 16378, *Cereals – Determination of impurities content in maize (*Zea mays*, L.) and sorghum (Sorghum bicolor, L.)*