The International Egg Commission

International Egg and Egg Products Guidelines

Including:

Guidelines for the hygienic production and distribution of shell eggs and egg products

and

Global standards of identity for liquid and dried egg products

May 2012

These guidelines are produced and published by the International Egg Commission. This most recent edition, published in 2012, followed an extensive review of the original document, first published in 2007, and takes account of developments in science, genetics and industry best practice. Particular scrutiny was given to the data relating to egg chemistry in “Annex A” and “Annex B”. Our sincere thanks go to Mr Wulf Bostel (Chartered Analytical Food Chemist) of the Analytical Institut Bostel, Stuttgart, Germany and Dr Glenn Froning (PhD) of the University of Nebraska, USA who collaborated to provide the scientific basis for these guidelines.

I General

Introduction

1. The IEC is the only organization that represents the producers of eggs and egg products on an international basis. The IEC is internationally recognised and has formal relationships with leading global organisations including the OIE (world animal health organisation) and the Codex Alimentarius Commission. These guidelines are based on the best and most recently available scientific information. They lay down minimum global standards for the production, distribution and identity of eggs and egg products. The IEC represents members in over 55 countries around the world. Industry bodies in each country should use these guidelines, along with veterinary advice, as a benchmark for their own codes of practice.

The Chain

2. It is important that the hygienic chain is maintained from breeding flocks / hatcheries right through to the final consumer. Pullet rearers should only obtain birds from breeders/hatcheries who are conforming to these guidelines, egg producers should only obtain birds from pullets rearers who are following these guidelines, packers should only receive eggs from producers who are following these guidelines and should insure that instructions for the hygienic keeping of eggs are passed on to their retailer/caterer customers and to the final consumer. Egg processors should source their raw materials from producers and packers following these guidelines.

Validation

3. The IEC believes that all egg producers and processors should strive to achieve these guidelines. Any business or organisation claiming that they achieve these standards must have a verifiable validation system in place.

II Shell Eggs

Special Requirements Relating to Breeding Flocks/Hatcheries

4. Parent breeding flocks should not be kept on the same holding as grandparent or elite breeding flocks. Unique genetic material should be kept in more than one building and on more than one holding. Birds of only one age should be kept on an "all-in-all-out" farm and should be obtained from a single source and should be kept inside the buildings.

5. All eggs intended for incubation should be sanitised on the day of lay.

6. At hatcheries, eggs should be collected from breeding farms regularly; only clean eggs should be collected for incubation and should be sanitised. A one-way system for the flow of eggs and chicks should be operated. Adequate ventilation should be provided.

Salmonella Control

7. All countries must have an active and continuous programme to monitor salmonella levels. Where salmonella is a problem special control measures are necessary. Appropriate procedures should be laid down for the testing of birds, eggs and the environment.

8. Procedures for dealing with salmonella contamination in breeding flocks and chicks in hatcheries must be established.

9. Pullet rearing flocks must be tested for salmonella as close as possible to the time when they are moved to egg laying facilities. Positive test results must be dealt with according to the established procedure.

10. In laying flocks the birds must be tested one week before depletion in order to determinate the degree of sanitising which is needed before the laying house is refilled with birds.

11. In countries where salmonella is a problem, if positive results are found in the birds, culture tests must be taken from the environment. After sanitising has been carried out further cultures must be taken and restocking must not take place until all samples are negative. In deep pit houses, when positives are found the pit must be cleaned out and sanitised.

12. If salmonella enteritidis (S.e.) is a persistent problem, sample testing of eggs from each farm each quarter is recommended. Vaccination of the birds must be also considered in accordance with local veterinary advice.

Location of Poultry Buildings

13. Poultry buildings must be located away from other farm holdings. Ideally the perimeter of the farm should be fenced and gated securely with parking facilities away from the buildings. The site must be kept clean and tidy.

Construction of Poultry Buildings

14. Buildings must be sound in structure and repair and constructed in a way that prevents the entry of wild birds and rodents and infestation by insects. All surfaces must be smooth and impervious with all insulation materials being odourless and rot proof. Materials which cannot be cleaned easily must not be used. Floors must be proofed against rot and water, easy to clean and laid in a way which facilitates the drainage of water. Ancillary rooms (e.g. food

stores, egg stores, changing rooms, break rooms, toilets, equipment and other stores) must be a similar standard to those of livestock buildings.

Staff

15. Staff must be trained in hygiene control. Each farm must produce its own manual of working instructions, which contains a check list of routine hygiene and husbandry tasks, for use by staff. Foot baths, adequate hand washing and toilet facilities must be provided and regular use encouraged. Protective clothing must be provided, changed and laundered regularly, smoking and the consumption of food must only be allowed in specified areas.

Vermin Control

16. Poultry houses and ancillary building must be wild bird and rodent proof and effective measures must be taken to control vermin and flies and other arthropods including the elimination of potential breeding areas. Rodent control is enhanced by the control of vegetation around the buildings. A vermin control book must be kept.

Sanitising

17. Sanitising must be carried out between flocks using approved, or recognised, disinfectants. Steam cleaning is recommended where possible and appropriate. Particular attention must be paid to equipment such as ventilation systems, feeders, drinkers, waterlines and header tankers all of which must be sanitised. In countries where salmonella is a problem, sanitising and testing must be carried out in accordance with the above guidelines on salmonella control.

Domestic Animals

18. Domestic animals must not be allowed into poultry houses or ancillary buildings.

Visitors

19. Visitors must be kept to the minimum necessary and must be subjected to the same degree of hygiene control as staff.

Transport

20. All vehicles (and equipment) used for catching and transporting poultry are high risk items. Cleansing and disinfection is a high priority before and after each occasion on which these items are used. Ideally, It is best practice to use dedicated transport and equipment.

Feed

21. Feed should only been sourced from establishments achieving standards of hygiene and quality that are recognised by a reputable independent body.

22. Feed companies must guarantee that their feed does not contain levels of prohibited substances, such as antibiotics, that can contaminate the contents of the egg.

23. Vehicles used for carrying raw ingredients must not be used for carrying finished feeds until they have been effectively cleaned.

24. All appropriate measures must be taken to prevent the recontamination of feed during its storage and distribution on the farm. Particular attention must be paid to the cleanliness of the bulk storage bins, augers, hoppers and chain feeders.

General Equipment

25. A clean and tidy store of equipment and tools must be maintained free of obsolescent equipment and rubbish. Equipment must be cleaned after each use and before storage.

Litter

26. All used litter must be incinerated or removed from the site.

Birds

27. Any sick or infected birds must be culled as soon as they are identified. Dead birds must be collected promptly and placed in a waterproof, leak proof, container ready for incineration or for immediate removal from the site.

Extensive Flocks

28. Hygiene control is more difficult in extensive egg production systems (for example, free range units cannot be rodent and wild bird proof). Every effort must be made by the producers to maintain the standards of good practice laid out in these guidelines.

On Farm Handling of Eggs

29. Staff handling eggs for human consumption must regard themselves as food handlers and must be trained in hygiene. They must wash there hands before and after egg collection.

30. Eggs should be collected frequently and dirty eggs, cracked and broken eggs must be removed from the collection system as soon as possible. Dirty and cracked eggs must only go for human consumption via a pasteurising / processing plant. Broken eggs (i.e. where both the shell and membrane are broken) and incubated eggs which have not hatched must not be used as food for human consumption.

31. Prior to distribution eggs must be stored in rooms separate from poultry. They must be kept at a constant temperature and below 20˚C and stored in the correct conditions to avoid surface condensation. All egg production and packing units, equipment and transport must be kept in a hygienic condition and regularly cleaned. Egg collecting vehicles must be visibly clean. Unless new or sanitised egg trays are used, arrangements must be made with egg packers to return egg trays to the individual premises from which they originated. Dirty of soiled trays must not be used.

32. The laying house must be kept clean and as free as possible from broken liquid egg. Dead and culled birds must be removed before egg collecting and egg belts must be regularly cleaned, serviced and maintained.

33. There must be an effective and well maintained system of manure removal to prevent faecal contamination of eggs and feed troughs.

Distribution of Eggs from Farm to Consumer

34. Eggs must be stored and transported within a system which avoids excessive temperature fluctuations and where the temperature does not exceed 20˚C. Eggs must be sold under a “best before” date to ensure high quality and that consumers receive accurate and relevant information. It is recommended that eggs in the home or on catering premises be stored in a refrigerator below 8˚C, with appropriate storage information being included on egg packs.

35. Eggs must be delivered to the packing station as soon as possible after lay.

36. All egg movement is to be accompanied by written documentation including proof of the farm of origin.

37. Packing station premises must be reserved for the handling and storage of eggs. They must be built and equipped to provide suitable ventilation, adequate lighting and to facilitate proper cleaning and disinfection. They must be of sufficient area in relation to the volume of work done and include all the necessary technical equipment to ensure the proper handling of eggs. The premises and equipment must be kept in good repair and free of extraneous odours.

38. Good manufacturing practise must be adhered to at packing stations with written HACCP controls to include adequate cleaning procedures; traceability of product and records to be maintained at all times; written product re-call procedures to be in place.

39. Set levels of hygiene relevant to the handling of food must be adhered to. Effective crack and blood detection must be used in the grading of eggs. Records must be held on site for a minimum of two years. Egg boxes must carry storage instructions for the consumer or caterer.

40. Retailers must be advised that eggs

    (a) Be stored in there outer boxes, prepacks or keyes trays in a clean, dry place away from strong smelling foods and possible contaminants;

    (b) Must not be stored or displayed

        (I) Near to heat sources such as fridge motors or fan heaters.

        (II) In shop windows or direct sunlight.

    (c) Be isolated from any pre-cooked or raw foods and that hands must always be washed prior to and after handling.

    (d) Be sold in strict rotation (i.e. first in, first out), with display cabinets cleared completely twice a week.

III Egg Products

General

41. The principals laid down for the production of eggs in relation to the construction of premises, hygiene of staff and equipment and the control of rodents and vermin apply equally to egg processing plants.

Layout of Premises

42. Egg processing facilities must have separate areas including areas for:

    (a) The storage of shell eggs, egg washing (if required) and machine loading

    (b) The separation of eggs (yolk and white), filtering, cooling, storage in tanks of un-pasteurised liquid egg (including storage for raw, un-pasteurised liquid / frozen egg products arriving at the plant) and closed circuit pasteurisation (excluding batch pasteurisation).

    (c) The storage of pasteurised products and packaging

    (d) Fermentation and concentration of liquid egg and spray drying equipment

    (e) Packaging dried egg white

    (f) Storage of dried egg white prior to a hot room

    (g) Hot room pasteurisation of egg white powder

    (h) Egg yolk treatment and spray drying equipment for yolk and whole egg

    (i) Packaging dried yellow products

    (j) Refrigerated storage for finished (packed) liquid products at less than 5° C

    (k) Storage for finished dried products at less than 20 ° C

    (l) The preparation of products not intended for human consumption including inedible egg products and eggshell processing

    (m) The storage of additives

    (n) The storage of cleaning and disinfectant products;

    (o) Changing rooms and toilets for personnel

Raw Material

43. Eggs obtained from other species (e.g. duck, geese, turkeys, guinea fowls or quail) must not be mixed with hen egg products that are being processed for human consumption.

44. Unhatched eggs from incubators and cracked eggs (i.e. where both the shell and membrane are broken) must not be used for the production of egg products used for human consumption.

45. Dirty eggs must not be allowed to contaminate the egg contents.

46. Eggs must be sourced from producers who are following these guidelines.

47. Eggs for the production of products for human consumption must not be broken by centrifuging or crushing. Egg white obtained from centrifuging empty shells or from shell conveyors must not be used for human consumption. Shells and membranes must be kept out of the products. Shell eggs must be stored in cool conditions at a constant temperature of below 20˚C and processed within seven days of receipt. Eggs held below 8˚C throughout the production / distribution chain may be processed within eight weeks.

48. Containers of shell eggs arriving at the processing plant must be clearly labelled to give the name of the farm or packing station and the date of packing. The date of receipt at the processing plant must be marked on these containers. Raw liquid egg products arriving from outside the plant must be carry traceability information stating date of breaking.

49. Where liquid egg is brought in from a packer or from another processing plant it must either have been deep frozen or chilled to a temperature of not more than 4˚C at the place where the eggs were broken. Chilled egg must be treated within 72 hours following the day of breaking the eggs.

50. A technically qualified person from the processing plant must inspect the suppliers of their eggs / products on a regular basis and at least annually.

Staff

51. Staff must be trained in hygiene requirements and to inspect and reject unsuitable eggs and / or consignments. They must produce a medical certificate indicating that there is no reason to prevent them handling eggs or egg products. The medical certificate must be updated yearly unless a staff medical check-up scheme is in operation.

Finished Products Standards

52. Egg products must undergo suitable treatment which will enable the finished product to meet the standards laid down in Appendix A.

Analytical Standards

53. Analytical standards must be laid down, as recommended in Appendix B.

54. The analysis and test methods used to establish conformity to these standards must be recognised internationally.

55. A sample from each day's production of each type of product must be kept and frozen for at least one month for use as a reference. If the reference sample has been taken from a batch where part or all has been sold frozen the sample must be kept for at least four months.

Additives

56. It is recommended that additives including salt and sugar or other additives are added to the egg product prior to pasteurisation. Where this is not possible, salt and sugar must be sieved before adding post pasteurisation.

Freezing / Defrosting Procedure

57. The freezing of products must be carried out rapidly using blast freezing techniques and be solidly frozen in accordance with domestic food safety authority guidelines, or within a maximum of eighteen hours if no domestic guideline is in place.

58. Defrosted egg must be re-pasteurised before despatch. It must not be left to defrost at ambient temperatures. In its frozen form it must be put through a block chipper and into a steam / water jacketed stainless steel vat which does not operate higher than 60˚C. The defrost process must be completed within two hours and egg repasteurised within a further two hours.

Packaging

59. Egg products must be packaged in hygienic conditions which ensure they are not contaminated, do not impair the organoleptic characteristics of the product and cannot transmit to the egg products substances harmful to human health. They must be strong enough to protect the egg products adequately. They must be clean prior to being filled and reusable containers must be cleaned, disinfected, sanitised and rinsed before being filled again.

60. Immediately after packaging the containers must be closed and placed in a separate storage room.

61. Containers which are used for the transport of egg products in bulk must have there inside surfaces made of a material which is easy to wash, clean and disinfect and can resist corrosion. They must be designed so that the egg product can be removed completely and any taps should be easy to remove, dismantle, wash clean and disinfect. The containers must be washed, cleaned, disinfected and rinsed immediately after each use. They must be sealed after being filled and remain sealed during transportation until they are used. They must be reserved for the transport of egg products.

Storage and Transport

62. During storage and transport the temperature must not exceed the following values:

Deep frozen products	-18˚C
Frozen products	-12˚C
Chilled products	+ 4˚C

Water Supply

63. Only potable water can be supplied except for steam production, fire fighting and the cooling of refrigeration equipment provided that the steam and water concerned can not come in to contact with the egg products or be used for cleaning or disinfecting containers, plant or equipment which comes in to contact with egg products. Pipes carrying non-potable water must be clearly distinguished from those carrying potable water.

Cleaning

64. Detailed written cleaning schedules must be available for all items of equipment (including returnable delivery containers) and for all parts of the manufacturing environment. There must be a system, with appropriate signatures, for recording that the schedules are being followed. Swabs must be used on a regular basis to monitor the efficiency of the cleaning. Where cleaning in place systems are used, there must be separate systems for raw and pasteurised lines. Detergents must be of food quality and compatible with terminal sanitizers.

Records

65. Appropriate records of functions and procedures must be kept.

Marking of Egg Products

66. Every consignment of egg products leaving a processing establishment must bear a label showing the temperature at which the egg products must be maintained and the period during which their conservation may thus be assured. Information on shelf life and storage conditions must be clearly shown.

References

AEB. 2006. American Egg Board – Egg Products Reference Guide. AEB: Chicago.

Bostel, W. 2007. New Research in Egg Chemistry. Paper to International Egg Commission 27th March, 2007. Analytisches Institut Bostel: Stuttgart.

IEC. 1999. International Egg Commission - Guidelines for the hygienic production and distribution of eggs and egg products, November 1999. IEC: London.

Appendix A

Egg Chemistry: Recommended Standards of Identity

Standards of Identity

67. Global standards of identity for egg products are of increasing importance as international trade increases. The International Egg Commission (IEC) first established standards of identity in November 1999, published in its “Guidelines for the hygienic production and distribution of eggs and egg products”.

68. In 2006 and 2007 the IEC updated this document and undertook an extensive review of the most up to date scientific research, which took into account developments in genetics and industry practice. A review of recent research was conducted by Mr Wulf Bostel (Chartered Analytical Food Chemist) of the Analytical Institut Bostel in Stuttgart, Germany and Dr Glenn Froning (PhD) of the University of Nebraska, USA. This included extensive use of the 2006 research by Covance Laboratories commissioned by the American Egg Board (AEB) and published in the AEB’s “Egg Products Reference Guide”.

69. In addition the IEC commissioned new scientific research at the Analytical Institut Bostel in Stuttgart, Germany, using commercial egg product samples taken from the EU, USA, Canada, India and Argentina.

70. The results of the new research were compared with the results from Covance Laboratories and the IEC’s existing 1999 standards. A recommendation was then put to IEC members for review, to ensure that the proposed standards had value in the commercial industry.

71. The standards of identity in Appendix A were approved by the International Egg Commission in 2007 as being a representative global standard. These standards contain a data range for some indicators. This is essential due to variances including those caused by differing processing equipment, on-line / off-line breaking configuration, age of egg, hen genetics and welfare standards.

72. Specific technical definitions were used to establish the difference between "Lipid" and "Fat". Values for "Total Fat" include Glycerol Esters and Fatty Acids. Values for "Total Lipid" include Glycerol Esters, Fatty Acids, Cholesterol and Phospholipids.

73. The values given in Appendix A are only valid if achieved using the specific methodology stated in Appendix C.

74. Egg products with chemistry values below the recommended minimums are acceptable on condition that they are guaranteed to be from un-standardised natural break”

Table 1 Egg Chemistry Standards

Appendix A **IEC Proposed Egg Chemistry Standards 2007**

	Total Solids %	Total Fat %	Total Lipid %	Free Fatty Acids	Cholestrol % dry matter	pH	Protein % (N x 6.25)	Ash %
Liquid / Frozen								
Whole Egg	23.0 min	8.4 min	9.8 min	-	1.53 min	7.2 - 7.7	12.0 min	0.96 - 1.02
White	10.5 min	-	-	-	-	8.8 min	-	-
Yolk	43.0 min	23.0 min	25.6 min	-	2.2 min	6.0 - 6.7	-	-
Dried								
Whole Egg Spray Dried	95.0 min	39.0 min	41.2 min	3.5 max	1.53 min	-	47.7 min	4.2 - 5.0
White Fermented Spray Dried	91.5 min	0.4 max	-	-	-	-	-	-
Yolk Spray	95.0 min	56.0 min	61.6 min	3.5 max	2.37 min	-	33.1 min	3.9 - 4.3

Note:

These guidelines contain a data range for some indicators.

This is essential due to variances including those caused by differing processing equipment, on-line / off-line breaking configuration, age of egg, hen genetics and welfare standards.

These figures are only valid if achieved using the specific methodology stated in Appendix C

These are different technical definitions between "Lipid" and "Fat"

"Total Fat" includes Glycerol Esters and Fatty Acids
"Total Lipids" includes Glycerol Esters, Fatty Acids, Cholesterol and Phospolipids

Test Methodology Summary (full details in Appendix C):

Dry matter – Air oven & integrated analytical balance

Cholesterol – Enzymatic method

Total lipids – extraction / gravimetric

Total fat – after acid breakdown

Total protein – Kjeldahl (N x 6.25)

pH-value – potetiometric

Appendix B

Egg Products:
Recommended Analytical Standards

1. Microbiological criteria

(a) Salmonellae: absence in 25g (or 25ml) of egg product

(b) Other criteria:
- mesophillic aerobic bacteria: M = 10^4 in 1g (or 1ml)
- enterobacteriaceae: M = less than100 per 1g (or 1ml)
- staphylococcus aureus: negative per test

Note:

M = maximum value for the number of bacteria; the result is considered unsatisfactory if the number of bacteria in one or more sample units is M or more.

2. Other Criteria

(a) The concentration of 3 OH-butyric acid must not exceed 10mg / kg in the dry matter of the unmodified egg product.

(b) The lactic acid content must not exceed 1000mg / kg of egg product dry matter (applicable only to the untreated product).

With fermented products these values are those recorded before the fermentation process.

(c) The quantity of eggshell remains, egg membrane and any other particles in the egg product must be negligible.

Appendix C

Liquid and Dried Egg Product Test Methodology

Test Methodology Summary:

- Total Solids / Dry matter – Air oven and integrated analytical balance
- Total protein - Kjeldahl (N x 6.25)
- Total fat - acid breakdown
- Total lipids - extraction / gravimetric
- Ash – (550ºC)
- pH-value - potentiometric
- Cholesterol - Enzymatic method

Total Solids / Moisture - Air oven method

Preparation of drying cups

(a) Liquid products:
- Fill a deep drying cup with 40 – 50 grammes of sea sand and a small glass bar
- Dry the cup at 103ºC for 3 hours in the drying oven
- Cool the cup in a desiccator for 1 hour

(b) Dried products:
- Dry a base drying cup at 103 °C for 3 hours in the drying oven
- Cool down the cup in a desiccator for 1 hour

Initial weight of the sample – (depends on the expected moisture)

Moisture	Weight
< 20%	8 – 10g
20 – 50%	6 – 8g
50 – 80%	4 – 6g
80 – 90%	3 – 4g

Liquid and Dried Products
- Weigh the empty cup
- Weight the sample in a dried cup,
- Admix liquid products with the sea sand until it is a smooth mass with the glass bar
- Dry all samples for 4 hours at 103ºC in a drying oven
- Cool the cup for 1 hour in a desiccator
- Weigh the cup with the sample
- Calculate and report percentage solids

Calculation:

Dry matter (%) = (A – T) / E x 100

E = initial weight of the sample (grammes)
T = weight of the dried empty cup (grammes)
A = weight of the dried cup with sample (grammes)

Moisture (%) = 100 – dry matter (%)

Protein (Kjeldahl determination)

Mince and homogenise the sample

initial weight of the sample (E) - (depends on the expected protein)

protein content	weight
<1 %	8 g
1 – 5 %	2 – 3 g
5 – 10 %	1 – 1,5 g
10 – 20 %	0,5 – 1 g
> 20 %	0,5 g

- Weigh the sample in a Kjeldahl flask
- Add 20 ml sulphuric acid, two catalyst tablets and 2 glass pearls
- The digestion takes place at 400 – 410 °C for 3 hours in a Kjeldahl digestion apparatus (after that the solution in the tube is clear)
- Carry out a steam destillation with the cooled sample solution (add 100 ml sodium brine (30 %), 100 ml water and 60 ml boron acid (4 %) as "solvent" for the nitrogen and titrate the transferred nitrogen with sulphuric acid (0,1 N)

$$\text{protein content (\%)} = \frac{V \bullet F \bullet t}{E}$$

V: consumption of the sulphuric acid
F: 0,875 (N x 6,25): conversion factor for egg-products
t: titre of the sulphuric acid
E: initial weight of the sample

Total Fat Acid Hydrolysis Method (Total fat includes Glycerol Esters and Fatty Acids)

1. (a) Accurately weigh about 3 g of liquid whole eggs or 2 g of liquid egg yolks or 1 g of dried whole eggs or dried egg yolks into a Mojonnier or retort fat extraction tube.

1. (b) Accurately weigh about 5 g of liquid egg whites or 1 g of dried egg whites into a Mojonnier or retort fat extraction tube.

- While vigorously shaking the extraction tube, slowly add 10 ml of concentrated hydrochloric acid (HCL) to the tube with the liquid egg sample, or 19 ml of diluted hydrochloric acid (HCL) (4 parts acid, 1 part distilled water) to the tube with the dried egg sample.
- Place the tube in a water bath at 70˚C and bring the water in the bath to boiling. Keep the tube in boiling water for 30 min.
- Carefully shake the tube at 5 min. intervals.
- Remove the tube from the bath and add deionized distilled water to nearly fill the lower bulb.
- Cool to room temperature.
- Add 25 ml petroleum ether, stopper the tube, and shake vigorously. Periodically, loosen stopper carefully to release the pressure inside the tube.
- Add 25 ml petroleum ether (boiling point 30 to 60˚C). stopper the tube, and shake vigorously. Periodically, loosen stopper carefully to release the pressure inside the tube.
- Let stand until the solvent layer separates from the water and the upper layer is practically clear (about 20 min.).
- Decant the solvent into a conditioned and tared 100 to 250 ml glass beaker or flask.
- Evaporate the ethers to dryness very slowly under a hood using a hot plate or steam bath. This occurs very rapidly, therefore, the beaker should only be warm.
- Repeat steps 7, 8, 9, and 10 for second extraction.
- Repeat steps 7, 8, 9, and 10 for third extraction.

- Transfer the dish to a convection oven at 100˚C for 10 min., a vacuum oven at 100˚C for approximately 10 minutes or an atmospheric oven at 135˚C for approximately 5 min. until a constant weight is achieved. Cool to room temperature (approximately 30 min.).
- Weigh, calculate, and report as a percent of fat by acid hydrolysis.

Notes

a. The ethers used are highly flammable. DO NOT EVAPORATE ON OR NEAR OPEN FLAMES!!
b. The evaporation must be done in a ventilated hood.
c. Stoppers for the fat extraction flasks must be cork, meoprene or other synthetic rubber. Do not use natural rubber stoppers since ether, fats, and oils are solvents for natural rubber. Also, do not use wax impregnated corks.
d. The beaker or flask used for evaporation is to be conditioned as follows: Before any weighing, heat in oven at 100˚C for 10 min. Cool at room temperature (approximately 30 min.) until a constant weight is attained. Beakers or flasks that contain fat or oil do not lose heat quickly.

Total Lipid (Total lipid includes glycerol esters, fatty acids, cholesterol and phospholipids)

Preparation:

1. Homogenize the samples
2. Dry a 250 ml round bottomed flask for 1 hour at 103ºC
3. Let it cool down in a desiccator and weigh the round-bottomed flask (m1)

Initial weight of the sample: (m0) (depends on the expected lipids)

Egg product	Weight
Liquid whole egg	4 – 5 g
Liquid egg yolk	1 – 2 g
Dried egg yolk	1 – 1.5 g
Dried egg yolk	0.5 – 1 g

- Weigh the sample in an extraction cartridge with 25 grams of sea sand
- Homogenise the sample with a glass bar, and then add 25 grams of sodiumsulfate and homogenize again
- Cover the mixture with cotton and extract the lipids in a hot extraction tube with 100 ml cylohexane / ethanol (1/1) for 6 hours
- Filter the ether-solution in a prepared round-bottomed flask and re-rinse with ether
- Evaporate the solvent again and dry the round-bottomed flask for 1 hour at 103ºC, weigh after 1 hour of cooling in a desiccator (m2)

Lipid Content w (%):

$$w = (m2 - m1) / m0 \times 100$$

Ash (550ºC)

1. Temper the ashing dish at 550ºC in a muffle furnace for 2 hours, cool down in the desiccator for 1 hour and weigh
2. Weigh 5 grammes of the sample into the ashing dish and add 1 ml of magnesium acetate solution (15%)
3. Homogenise with a glass bar
4. Clean the glass bar with an ashfree round filter and cover the sample with the filter
5. After controlled evaporation on a surface evaporator, put the ashing dish in a muffle furnace at 300 – 350ºC
6. Heat the muffle furnace to 600ºC
7. Incinerate the sample for 3 hours
8. Weigh the ashing dish after cooling in a deisccator for 1 hour
9. The ash content of the magnesium-acetate solution is aquired under comparable conditions in a multiple measurement

Calculation:

$$Ash\ (g / 100g) = (m2 – m3 – m1) / m0 \times 100$$

m2 = mass of ashing dish after incineration if the sample (g)
m1 = mass of the prepared ashing dish (g)
m0 = initial weight of the sample (g)
m3 = mass of the 1ml of the magnesium-acetate solution (g)

pH

A. Dried Egg Products

Testing methods using re-hydration:

- Dried whole egg powder: 1 part egg powder, 3 parts water
- Dried yolk powder: 1 part egg powder, 1 part water
- Dried egg white powder: 1 part egg powder, 7 parts water

Homogenise the samples and measure a 1% suspension at 25^{o}C with a pH Electrode (naturally the pH values is >7.0)

B. Liquid Egg Products

Mix the samples and the pH value is directly measured at 25^{o}C with a pH electrode

This publication is produced by the International Egg Commission.

Further information about this or any other IEC publications is available by contacting the IEC office:

The Director General
The International Egg Commission
89 Charterhouse Street
London
EC1M 6HR
United Kingdom

Tel: +44 20 7490 3493
Fax: +44 20 74903495
Web: www.internationalegg.com