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Nestlé Quality Assurance Center

DIETARY FIBER OVERVIEW





What is Dietary Fiber and how do you select the appropriate method?

Explore:

Evolution: Definition of Dietary Fiber

What Dietary Fiber means Today

Methods of Analysis in AOAC

Early, Interim and Current Testing Methodology

The Main Methods

How to Select Appropriate Testing

Dietary Fiber at NQAC

Timeline of Dietary Fiber Definition Evolution

1970's

"Dietary fiber consists of the remnants of edible plant cells, polysaccharides, lignin, and associated substances resistant to digestion by the alimentary enzymes of humans." Trowell

1985

Codex

Dietary fiber consists of carbohydrate polymers with ten or more monomeric units (DP>10), which are not hydrolyzed by the endogenous enzymes in the small intestines of humans.

2009

Codex

Dietary fibre means carbohydrate polymers* with ten or more monomeric units**, which are not hydrolysed by the endogenous enzymes in the small intestine of humans and belong to the following categories:

- Edible carbohydrate polymers naturally occurring in the food as consumed,
- Carbohydrate polymers, which have been obtained from food raw material by physical, enzymatic or chemical means and which have been shown to have a physiological effect of benefit to health as demonstrated by generally accepted scientific evidence to competent authorities,
- Synthetic carbohydrate polymers which have been shown to have a physiological effect of benefit to health as demonstrated by generally accepted scientific evidence to competent authorities.

*When derived from a plant origin, dietary fibre may include fractions of lignin and/or other compounds associated with polysaccharides in the plant cell walls. These compounds also may be measured by certain analytical method(s) for dietary fibre. However, such compounds are not included in the definition of dietary fibre if extracted and re-introduced into a food. **Decision on whether to include carbohydrates from 3 to 9 monomeric units should be left to national authorities.

Today

Dietary fiber definition by FDA (Final Rule - Ref 21 CFR 101, 81 FR 33741; 05/27/2016):

Naturally occurring fibers that are intrinsic and intact in plants, and added isolated or synthetic non-digestible soluble and insoluble carbohydrates **with beneficial physiological effects to human health**, such as:

- lowering blood glucose and cholesterol levels,
- increasing feelings of fullness (satiety) resulting in reduced calorie intake,
- and improving bowel function.

Analytical methods cannot distinguish between non-digestible carbohydrates that do and do not meet the dietary fiber definition.

Therefore, firms must keep records for those foods that contain both dietary fibers that do meet the regulatory definition of dietary fiber along with added non-digestible carbohydrates that do not meet the definition of dietary fiber.

The amount of dietary fibers declared should represent the total fiber that is quantified by analytical methods minus the amount that does not meet the dietary fiber definition.

Nutrient or ingredient?

Dietary Fiber is a nutritional property of Food. It refers to the nutrients name not to a specific component, ingredient or specific analyte.

It may consist of:

- Naturally occurring edible carbohydrate polymers.
- Food Additives or Ingredients such as: Pectins, Carrageenan, Agar, Alginates, Guar gum, Cellulose, Beta-glucans, Resistant Starches RS 2 or RS 3, Polydextrose, Resistant Dextrin, Inulin, FOS, GOS, Psyllium, Wheat, Rye, Corn, Oat and Barley Fibers.
- A number of naturally occurring Fibers and some common Food Additives fall into CODEX Definition I – DP >10 or HMW Fiber.
- Most Fiber Ingredients fall into CODEX Definition II – DP >3 - DP <9 or LMW Fiber.
- FDA defines Fiber as DP > 3 and only include those ingredients shown to have beneficial effects to human health

A closer look...

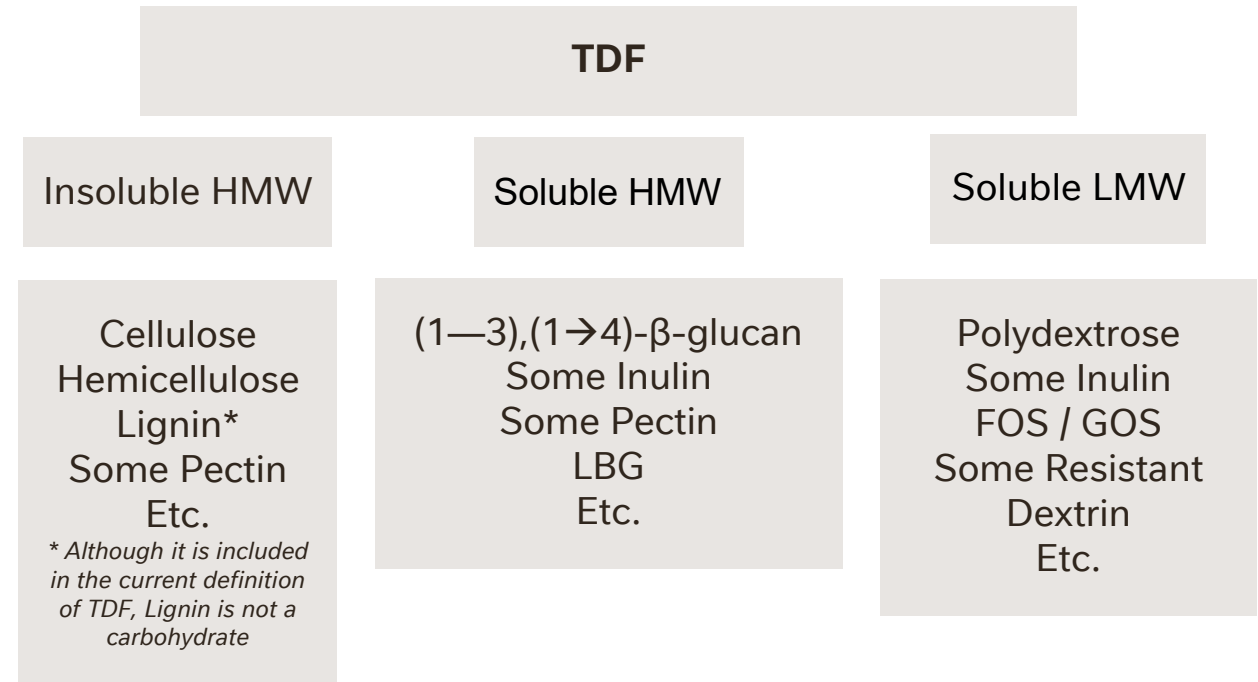
Total Dietary Fiber is composed of two forms: **Soluble** and **Insoluble** Fiber. Together they represent the **Total** fiber content in Foods.

Soluble Fiber dissolves in water to form a thick gel-like substance in the stomach. It is broken down by bacteria in the large intestine and provides some calories.

Insoluble Fiber does not dissolve in water and passes through the gastrointestinal tract relatively intact and, therefore, is not a source of calories

Depending on labelling requirements, individual Soluble and Insoluble Fiber determinations may be required.

AOAC Methods are available to determine Soluble and Insoluble Fiber and LMW/HMW.



In addition to soluble and insoluble, fibers are also defined by the degree of polymerization.

High molecular weight (HMW) is considered for molecules with >10 DP

Low molecular weight (LMW) is considered for molecules with <10 DP

Low molecular weight fibers consist mainly of soluble molecules.

METHODS OF ANALYSIS IN AOAC

- 985.29 – TDF (Prosky)
- 991.42 – Insoluble Fibre
- 991.43 – TDF, including soluble/insoluble
- 992.16 – TDF
- 993.19 – Soluble Fibre
- 993.21 – TDF in products with <2% starch and >10% fibre
- 994.13 – TDF (Uppsala)
- 997.08 – Fructans
- 999.03 – Fructans
- 2001.02 - GOS
- 2001.03 – TDF including resistant maltodextrin
- 2002.02 – Resistant Starch
- 2009.01 – TDF including low mw fibre (sometimes referred to as CODEX method)
- 2011.25 – TDF including soluble/insoluble/low mw
- 2017.16 – TDF including low mw fibre
- 2022.01 – TDF including soluble/insoluble/low mw
- 2000.11 – Polydextrose

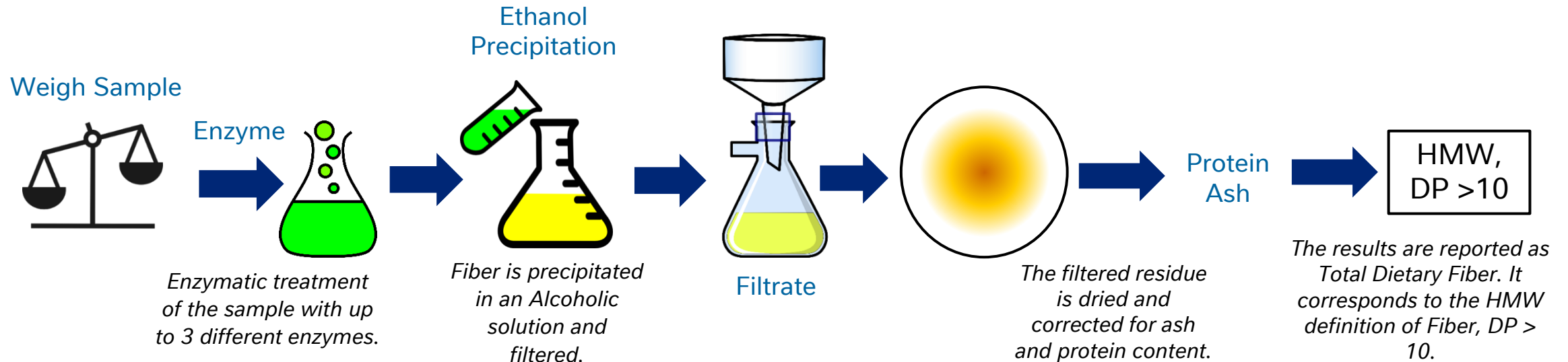


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References: AOAC 985.29 TDF, 991.43 TDF/ISF/SF

Early Testing Methodology



Interim Testing Methodology

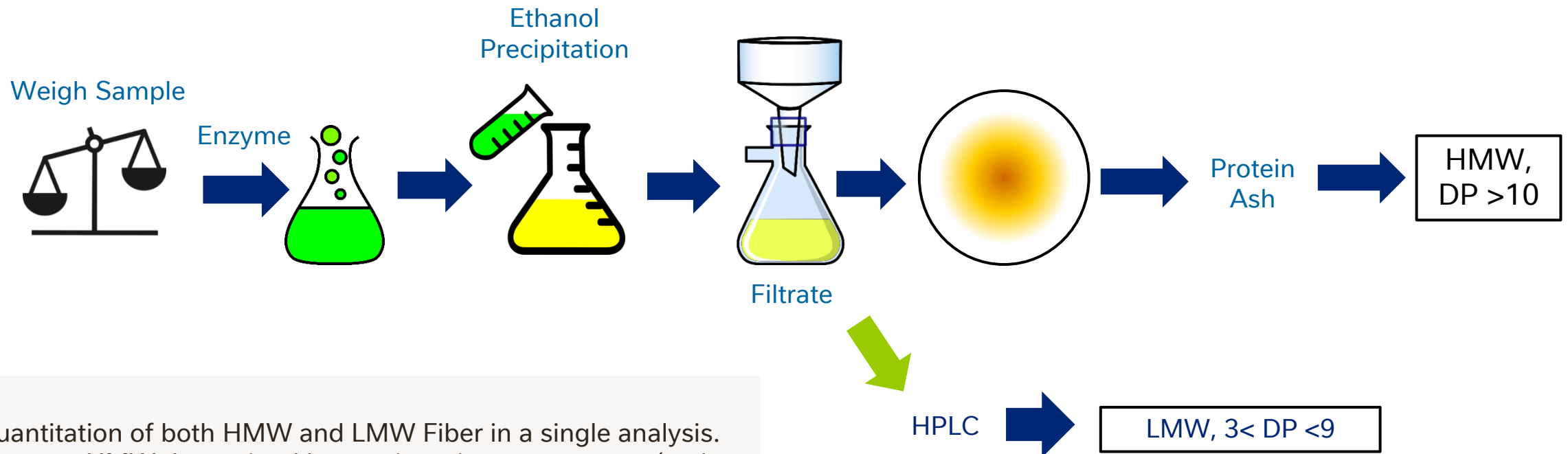
Introduction of LMW Fiber Ingredients

AOAC Methods evolved to quantify specific ingredients for GOS, FOS, Polydextrose and Resistant Starches. These methods use a variety of techniques to determine the LMW Fiber. The results from these determinations are often added to the HMW determination from above to report the Total Dietary Fiber.

References: AOAC 2001.02, AOAC 997.08 & AOAC 999.03, AOAC 2000.11, AOAC 2002.02 respectively.

References: AOAC 2017.16 TDF, AOAC 2022.01 TDF/ISF/SF

Current Testing Methodology Expanded Codex Definition



Quantitation of both HMW and LMW Fiber in a single analysis.
HMW determined by gravimetric measurement (early definition)
LMW determined by HPLC technology

Main Methods Summary

Method	TDF	Insoluble/ Soluble Differentiation	Low MW Fibre Included
985.29	Y	N	N
991.43	Y	Y	N
2017.16	Y	N	Y
2022.01	Y	Y	Y

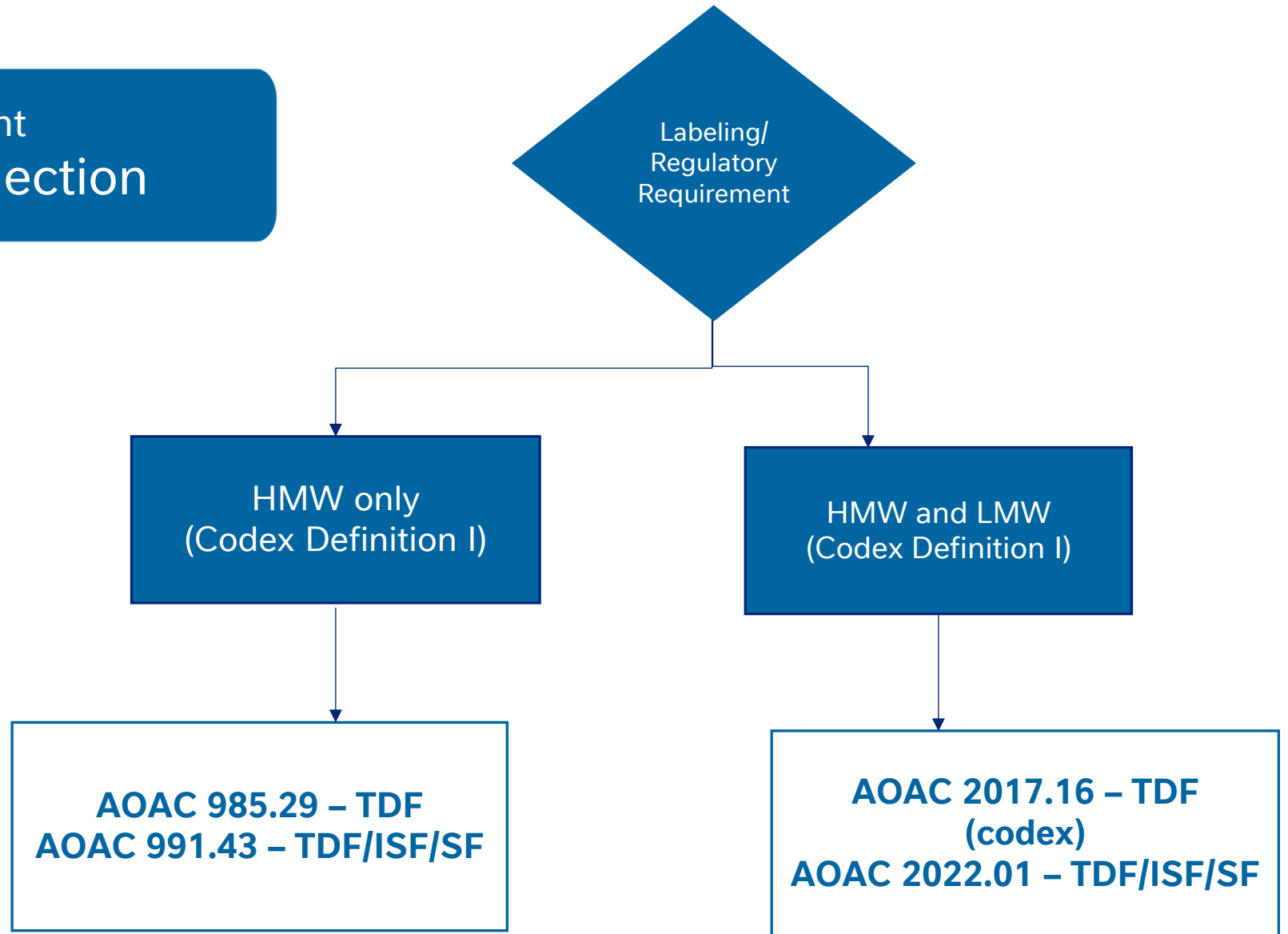


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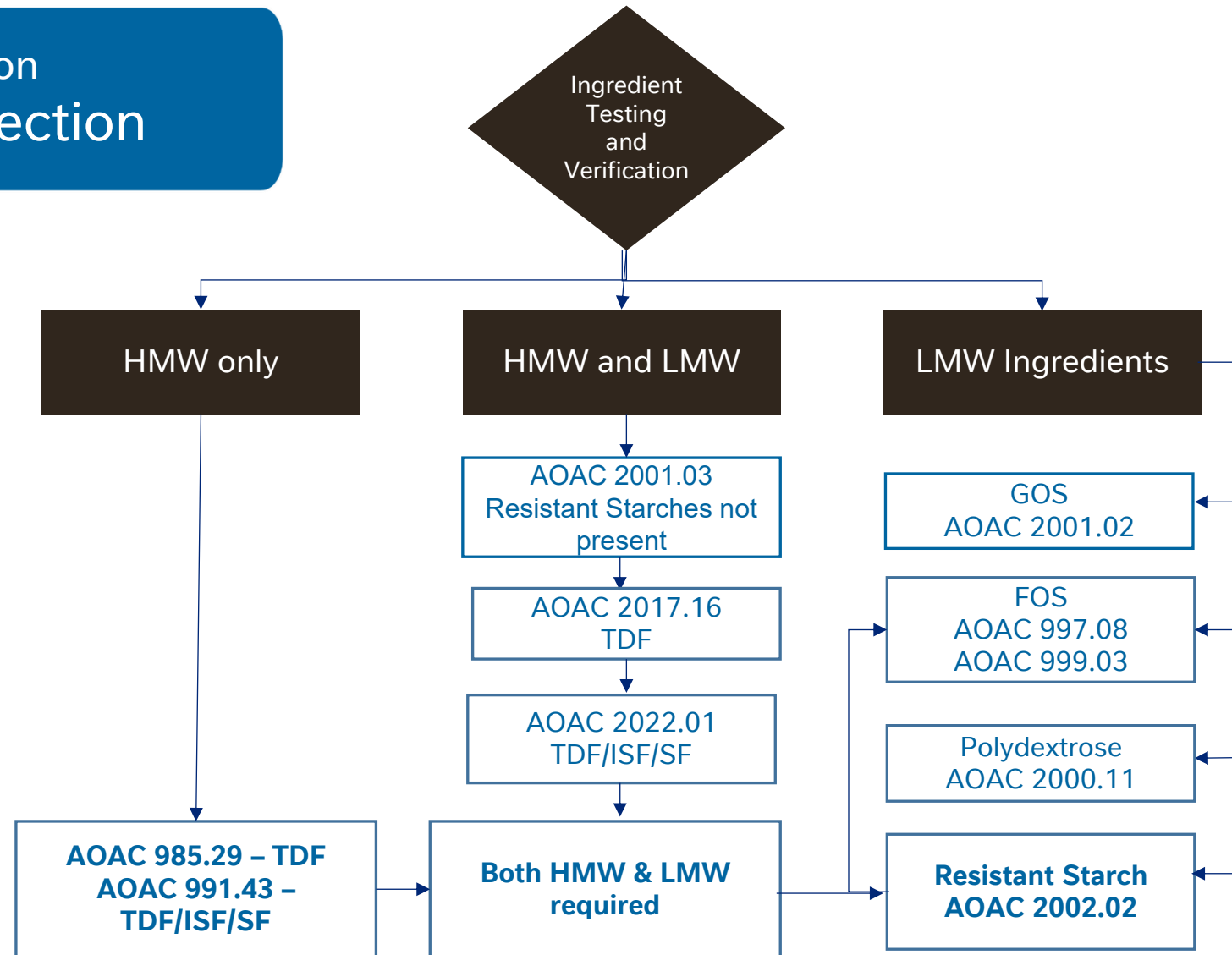
Labeling/Regulatory Requirement Appropriate Method Selection



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Ingredient Testing and Verification Appropriate Method Selection



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NQAC FIBER METHODS

Previous methods

LI-00.546 based on AOAC -985.29

AOAC 2009.01

AOAC 2011.25



Current methods:

AOAC 991.43

AOAC 2017.16

AOAC 2022.01

Thank you.



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Contact Customer Service with questions:
nqacdublininfo@us.nestle.com

