Title	**Explain additive mixing, compounding, and plasticisation of plastics materials**		
Level	**4**	**Credits**	**7**

Purpose	People credited with this unit standard are able to explain: health and safety requirements for plastics materials; dry stage mixing of materials; screw plasticisation of plastics materials; wet stage mixing of materials; and the use of additives in plastics materials.

Classification	Plastics Processing Technology > Plastics Materials

Available grade	Achieved
Recommended skills and knowledge	Unit 23131, *Compare melt flow and dimensional stability of plastics materials*.

Explanatory notes

1 Definitions
Dispersion – the wetting, individual separation, and distribution of each particle of pigment or additive in a polymer melt.
Distribution – the uniform mixture of pigment or additive in a polymer melt.
Materials – polymers or additives.
L/D ratio – the ratio of screw length to diameter.
Wet stage mixing – the compounding of pigments or additives in a polymer melt.

2 Legislation relevant to this unit standard includes but is not limited to
– the Health and Safety at Work Act 2015 (HSW)
– Hazardous Substances and New Organisms Act 1996 (HSNO)

Outcomes and evidence requirements

Outcome 1

Explain health and safety requirements for plastics materials.

Evidence requirements

1.1 The explanation describes the relevance and implications of the HSNO and HSW legislation to plastics processing workplaces.

1.2 The explanation describes hazards resulting from handling, storage, and processing of plastics processing materials.

Range hazards – dust, toxicity, flammability, chemical reactivity, fumes.

1.3 The explanation describes the principles of workplace compliance with HSNO and HSW legislation.

Range workplace compliance – existing and new equipment, materials, workplace procedures.

Outcome 2

Explain dry stage mixing of materials.

Evidence requirements

2.1 The explanation describes the mixing parameters associated with materials mixing and distribution.

Range mixing parameters – speed, shear, time.

2.2 The explanation describes the advantages and disadvantages of mixing equipment in terms of their mixing parameters.

Range mixing equipment – ribbon mixers, high-speed mixers, tumble mixers, vertical screw mixers;
mixing parameters – speed, shear, time.

2.3 The explanation describes the mechanisms for additive attachment to a polymer.

Range mechanisms – static, adhesion.

Outcome 3

Explain screw plasticisation of plastics materials.

Evidence requirements

3.1 The explanation describes how and where shear is produced in typical plastics processing equipment.

Range where – screw, barrel, dies, gates.

3.2 The explanation describes the function and typical design of a screw for different plastics materials in relation to the material characteristics.

Range plastics materials – polyolefins, PVCs, polycarbonate, nylon; design – feed zone, compression zone, metering zone, L/D ratio, mixing devices, for single screw configuration.

3.3 The explanation describes how the melt quality and output can be optimised using process variations.

Range process variations – barrel temperature profile, screw cooling, back pressure, speed;
melt quality – homogeneity, viscosity, temperature.

Outcome 4

Explain wet stage mixing of materials.

Evidence requirements

4.1 The explanation describes the three stages in achieving a dispersion of polymer and additive in a compound.

Range stages – wetting out, breaking down agglomerates, distribution.

4.2 The explanation describes how the three stages of dispersion are affected by shear and temperature.

4.3 The explanation describes the advantages and disadvantages of compounding equipment in terms of shear and temperature.

Range compounding equipment – roll mills, internal mixers, high-speed impeller mixers, single screw extruders, twin screw extruders, planetary extruders.

Outcome 5

Explain the use of additives in plastics materials.

Range five additives from the following – anti-blocking agent, anti-oxidant, anti-static agent, blowing agent, colourant, coupling agent, filler, flame retardant, heat stabiliser, impact modifier, lubricating agent, nucleating agent, plasticiser, processing aid, reinforcement, release agent, slip agent, thermal stabiliser, UV stabiliser.

Evidence requirements

5.1 The explanation identifies two types of each of the additives used which function in different ways, and describes their principle of operation.

5.2 The explanation describes the advantages and disadvantages of two types of each of the additives used which function in different ways.

Range advantages and disadvantages – cost, performance.

5.3 The explanation defines, for each of the additives, the function and required concentration of components used in typical product formulations.

Planned review date	31 December 2021

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	21 March 1997	31 December 2019
Revision	2	15 November 2002	31 December 2019
Review	3	24 August 2006	31 December 2019
Review	4	15 September 2016	N/A

Consent and Moderation Requirements (CMR) reference	0013

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.

Please note
Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMR). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

Comments on this unit standard

Please contact Competenz qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.