

The Simulation of Superfine Animal Fibre Fractionation: The Strength Variation of Fibre

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Abstract : This study investigates the contribution of individual Australian Superfine Merino Wool (ASFW) and Inner Mongolia Cashmere (IMC) fibres strength behaviour to the breaking force variation (CVBF) and minimum fibre diameter (CV_mFD) induced by actual single fibre lengths and the combination of length and diameter groups. Mid-side samples were selected for the ASFW (n = 919) and IMC (n = 691) since it is assumed to represent the average of the whole fleece. The average (L_mFD) varied for ASFW and IMC by 36.6 % and 33.3 % from shortest to longest actual single fibre length and -21.2 % and -21.7 % between longest-coarsest and shortest-finest groups, respectively. The tensile properties of single animal fibres were characterised using Single Fibre Analyser (SIFAN 4). After normalising for diversity in fibre diameter at the position of breakage, the parameters, which explain the strength behaviour within actual fibre lengths and combination of length-diameter groups, were the Intrinsic Fibre Strength (IFS) (MPa), Min IFS (MPa), Max IFS (MPa) and Breaking force (BF) (cN). The average strength of single fibres varied extensively within actual length groups and within a combination of length-diameter groups. IFS ranged for ASFW and IMC from 419 to 355 MPa (-15.2 % range) and 353 to 319 (-9.6 % range) and BF from 2.2 to 3.6 (63.6 % range) and 3.2 to 5.3 cN (65.6 % range) from shortest to longest groups, respectively. Single fibre properties showed no differences within actual length groups and within a combination of length-diameter groups, or was there a strong interaction between the strength of single fibre (P > 0.05) within remaining and removing length-diameter groups. Longer-coarser fibre fractionation had a significant effect on BF and IFS and all of the length groups showed a considerable variance in single fibre strength that is accounted for by diversity in the diameter variation along the fibre. There are many concepts for the improvement of the stress-strain properties of animal fibres as a means of raising a single fibre strength by simultaneous changes in fibre length and diameter. Fibre fractionation over a given length directly for single fibre strength or using the variation traits of fibre diameter is an important process used to increase the strength of the single fibre.

Keywords : single animal fibre fractionation, actual length groups, strength variation, length-diameter groups, diameter variation along fibre

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