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A VISCOMETRIC STUDY OF RHEOLOGICAL INTERACTION BETWEEN SELECTED COMMERCIAL DAIRY PROTEINS AND SELECTED GUMS IN AQUEOUS SOLUTION

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To my wife, Suwaranya, and
my daughter, Veeya,

ABSTRACT

Rheological interaction between solutions of four selected gum (locust bean gum (LB), sodium carboxymethycellulose (CMC), lambda-carrageenan (CR), xanthan gum (XN)) and solutions of four dairy proteins (sodium caseinate (SC), whey protein concentrate (WPC), coprecipitate (TMP), whey protein isolate (WPI)) were studied by steady shear viscometry using a Bohlin VOR Rheometer at 25 °C, natural pH and natural ionic strength. The rheological properties of mixed solutions were greatly influenced by presence of gum, gum concentration and gum type. Rheological synergism, with no obvious shear rate dependence, occurred between LB and SC, LB and WPC, LB and TMP, CMC and all dairy proteins, CR and WPC, CR and TMP, and XN and WPC. The degree of synergism, which was determined in a new way, was relatively much greater with TMP. The results are discussed in terms of Ca^{2+} bridging for TMP synergism and in terms of electrostatic and molecular space occupancy effects for SC, WPC and WPI synergism. No significant interaction occured between LB and WPI or between CR and SC or between CR and WPI or between XN and SC or between XN and TMP or between XN and WPI. Quantitative measures of synergism in mixed solutions prepared from 0.5% gum solution and 6.0% dairy protein solution were in close agreement with similar measures of synergism in mixed solutions prepared from 1.2% gum, 10.0% dairy protein and distilled water. Rheogical synergism was found to be unrelated to phase separation in the mixed solutions provided the phases remained intimately mixed. The relevance of this work to the use of the gum-dairy protein mixtures as rheologically-functional food ingredients is discussed.

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Wichai Kotaratititam

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ABBREVIATIONS

LB	=	Locust bean gum
CMC	=	Sodium Carboxymethylcellulose
CR	=	Lambda-carrageenan
XN	=	Xanthan gum
SC	=	Sodium caseinate
WPC	=	Whey protein concentrate
TMP	=	Total milk protein
WPI	=	Whey protein isolate
LB/SC	=	LB and SC mixed solutions
LB/WPC	=	LB and WPC mixed solutions
LB/TMP	=	LB and TMP mixed solutions
LB/WPI	=	LB and WPI mixed solutions
CMC/SC	=	CMC and SC mixed solutions
CMC/WPC	=	CMC and WPC mixed solutions
CMC/TMP	=	CMC and TMP mixed solutions
CMC/WPI	=	CMC and SC mixed solutions
CR/SC	=	CR and SC mixed solutions
CR/WPC	=	CR and WPC mixed solutions
CR/TMP	=	CR and TMP mixed solutions
CR/WPI	=	CR and WPI mixed solutions
XN/SC	=	XN and SC mixed solutions

XN/WPC	=	XN and WPC mixed solutions
XN/TMP	=	XN and TMP mixed solutions
XN/WPI	=	XN and WPI mixed solutions
N	=	No sediment was observed.
NG	=	Sediment was found but the solution appeared to be a gel-like mass.