What Makes a Cold Pressed Linseed Oil Bitter?

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Freshly cold pressed linseed oil serves in Germany for the human nutrition since ancient times in several traditional meals. It provides a high content of alpha-linolenic acid of about more than 50\% and besides this a delicate nutty and mild roasty flavour and no bitter taste is detected. After only one day of storage a bitter taste starts to develop and increases during some days or weeks to a very strong taste stimulus, which overrules all other sensations. During further storage also oxidation increases rapidly due to the high content of linolenic acid and at least after three to four month a rancid off-flavor is recognized by the nose resembling to linoleum or putty.

Cold pressed linseed oil is sold not only freshly pressed from oil mills but it is also available on the shelves of the super markets, which implies a storage time before consumption of at least some days up to several weeks. For this reason most consumers know linseed oil only as a strongly bitter tasting oil and think of it as a base for varnish.

The bitter aroma compounds were removed from strongly bitter tasting oil by extraction with a mixture of alcohol and water. The bitter aroma compounds were isolated by silica column chromatography and preparative reversed phase high performance liquid chromatography. The efluent was fractionated and the solvents from the fractions removed in order to identify fractions of interest by taste. The isolated bitter compound with the highest bitter value was characterized by infrared and UV-spectroscopy, by LC-MS and high resolution MS, by 1H-NMR and 13C-NMR (including HMBC, HMQC and COSY). The molecule is a cyclic octapeptide with the following amino acid sequence: proline-leucine-phenylalanine-isoleucine-methionine(sulfur oxidized to sulfoxide)-leucine-valine-phenylalanine. The amino acid analysis with ion chromatography confirmed these results. The lipophilic groups of the amino acids are in the outer positions. This molecule is already known in literature under the name of cyclolinopeptide E. However, the bitterness of this substance has not been evaluated and reported yet.