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ProductInformation

α-Lactalbumin
from bovine milk

Product Number **L 5385**
Storage Temperature -0 °C

Product Description

CAS Number: 9051-29-0
Molecular Weight: 14,175[1,2]
pI: approximately 4.5[3]
λ_{max}: 280 nm[4]
Extinction coefficient: $E^{1\%}$ = 20.1 (280 nm, phosphate buffer (5.2 g/L NaH_2PO_4 + 7.7 g/L Na_2HPO_4 in water))[4]

α-Lactalbumin is a small, globular, whey protein that has been found in all milk studied to date. It is a metalloprotein of approximately 14 kDa produced in the mammary glands.[5] It consists of a single polypeptide chain with 8 cysteines which form 4 disulfide bridges.[6] α-Lactalbumin binds several metal ions, including calcium, which is thought to play a role in the regeneration of native α-lactalbumin from the reduced, denatured form.[7] α-Lactalbumin also has a distinct zinc binding site that is thought to play a role in the binding of the lactose synthase complex.[5]

α-Lactalbumin regulates lactose biosynthesis by forming the lactose synthase complex with β(1→4) galactosyltransferase, which typically processes proteins in various secretory cells by transferring galactosyl groups from UDP-galactose to glycoproteins containing N-acetylglucosamine. In the lactating mammary gland, the specificity of β(1→4) galactosyltransferase is modulated by interaction with α-lactalbumin, which increases its affinity and specificity for glucose.[8] The complex then converts UDP-galactose and glucose to lactose and UDP. This reaction takes place in the Golgi lumen and requires Mn^{2+} ions.

Proteolytic digestion of α-lactalbumin by trypsin and chymotrypsin yields three peptides with bactericidal properties. These polypeptides have been shown to inhibit the growth of Gram-positive bacteria. In addition, a folding variant of α-lactalbumin was also shown to have bactericidal activity against various strains of *Streptococcus pneumoniae*.[9] Interestingly, native α-lactalbumin can be converted to the active bactericidal form by ion exchange chromatography in the presence of a cofactor from human milk casein, a C18:1 fatty acid. α-Lactalbumin posseses several classes of fatty acid binding sites indicating normal interactions with fatty acids may explain the multiple roles this protein possesses.[10]

A mulitmeric form of α-lactalbumin has also been described as potent a Ca^{2+}-elevating and apoptosis-inducing agent with broad, yet selective, cytotoxic activity, killing all transformed, embryonic, and lymphoid cells tested,[11,12] leaving mature, normal epithelial cells intact. This multimeric form appears to exist in milk. These oligomers have been shown to possess a molten-like globule state, a conformational change when compared to native α-lactalbumin. Multimeric α-lactalbumin was shown to bind to the cell surface, enter the cytoplasm, and accumulate in cell nuclei,[12] consistent with its ability to induce apoptosis. In addition, caspases were activated by aggregated α-lactalbumin and direct interaction of these multimers with mitochondria leads to the release of cytochrome c, which may be an important step in the initiation of the caspase cascade, and hence, induction of apoptosis, in these cells.[13]

In addition, it appears that both monomeric and multimeric α-lactalbumin can bind human milk oligonucleotides of various lengths.[14] This interaction was shown to block both the cytostatic and cytotoxic effects of α-lactalbumin.[15] This suggests that oligonucleotides secreted from mammary cells can serve as factors of regulation of the physiological state of mammary gland cells. Moreover, these oligonucleotides could control the cytotoxic potential of milk.

This product is prepared from raw, unpasteurized milk and contains saturating levels of calcium.[16]

Precautions and Disclaimer
For Laboratory Use Only. Not for drug, household or other uses.

Preparation Instructions
This product is soluble in water (50 mg/ml), yielding a clear to slightly hazy, colorless to faint yellow solution.

References

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