Xanthine alkaloids such as caffeine increase microcirculation and fat metabolism. By increasing microcirculation, one can reduce swelling and achieve a slimming effect. Increasing fat metabolism correlates to a reduction in adipose tissue in fat chambers that contribute to the appearance of cellulite. As a result, formulators frequently use caffeine in products designed to have slimming and anti-cellulite effects. When added to formulations, the antioxidant properties of caffeine can also help protect other actives in the formula. The antioxidant properties of caffeine protect the skin from extrinsic aging, as it is capable of scavenging hydroxyl groups (·OH) of free radicals with a reaction rate of $5.9 \times 10^9$ M$^{-1}$ sec$^{-1}$. This reaction rate illustrates that caffeine is comparable to other ·OH radical scavengers$^1$.

Studies have shown that Caffeine is also useful for increasing photoprotection and treating atopic dermatitis. A study funded by the Laboratory for Cancer Research investigated the benefits of topically applied caffeine and reported that after a twice weekly UVB exposure for 20 weeks, SKH-1 hairless mice that were treated with caffeine had a decrease in the occurrence of malignant and nonmalignant skin tumors by 44% and 72% respectively$^2$. Other research involving 83 patients published in Dermatology has shown that the topical application of caffeine effectively treats the symptoms associated with atopic dermatitis. It is hypothesized that the topical application of caffeine elevates levels of cyclic adenosine-$3',5'$-monophosphate by inhibiting phosphodiesterase$^3$.

**AC Caffeine Liposome** contains 1% Caffeine. By incorporating it into a liposome we can enhance the delivery of caffeine to maximize its efficacy. We suggest formulating with 1 to 10% **AC Caffeine Liposome** in cosmetic and personal care applications.

References:
2) Lehman Cullman, Susan. et. al. Topical applications of caffeine or (-)-epigallocatechin gallate (EGCG) inhibit carcinogenesis and selectively increase apoptosis in UVB-induced skin tumors in mce. PNAS. September 17, 2002. vol. 99. no. 19 12455-12460.