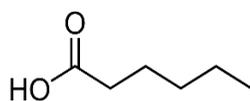


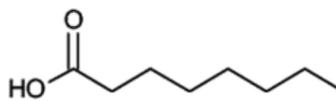
Medium Chain Fatty Acids (MCFA)

What are MCFA?

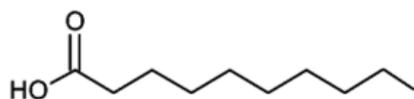
Found naturally in a variety of lipid sources including coconut oil, palm kernel oil and dairy products, MCFA are saturated fatty acids with a carbon chain length of either 6, 8, 10 or 12 carbons.



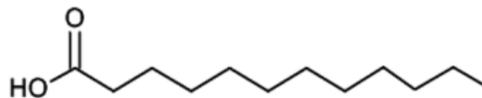
Caproic acid, C6



Caprylic acid, C8



Capric acid, C10



Lauric acid, C12

Do MCFA have any antimicrobial characteristics?

Over the years, MCFA have been well researched and have been shown to have antimicrobial properties against gram (+) and gram (-) bacteria, as well as viruses.^{1,2,3} MCFA are amphipathic, having hydrophilic and hydrophobic characteristic, similar to the phospholipid bi-layer of the cell membrane.⁴ Due to this similarity, they are able to insert themselves into the bi-layer of the membrane. This causes pores in the membrane to form, which disrupts the operations of the membrane and impacts cell permeability.⁵ The pores allow for leakage of the intercellular content, which compromises the cell's integrity leading to lysis of the cell and eventual cell death.⁶

Do MCFA have any other benefits when fed to animals?

Because MCFA are derived from palm kernel oil, it can be considered an energy source which is nutritionally available to livestock and poultry. Additionally, MCFA have been shown to be more efficiently absorbed and utilized as a source of energy, compared to long chain fatty acids. MCFA are absorbed in the small intestine and directly transported to the liver by the portal blood system. Since MCFA are more efficiently converted into energy, they are less likely to be stored as fat.⁷

Research in human health cites the use of MCFA for weight loss. How can we use them in animal feed and still expect improved performance?

Similar to the previous question, the answer lies in the absorption and metabolism of MCFA. As they are less likely to be stored as fat and increase short term energy expenditure, their use in calorie restricted diets may be beneficial for human weight loss.⁷ In pigs, this increase in available energy has been shown to improve energy supply and performance of piglets.⁸

Are MCFA corrosive?

Corrosivity of MCFA is dependent upon chain length. Shorter MCFAs such as caproic acid (C6) have corrosive properties to skin, similar to other short chain acids such as propionic acid and butyric acid. Longer MCFAs such as capric acid (C10) have lesser corrosive properties to skin, more like long chain fatty acids.⁹ Similarly, caproic acid (C6) must be shipped as a Class 8 corrosive liquid, while capric acid (C10) is not classified as hazardous for transportation under the Department of Transportation (DOT) regulations.^{10,11}

References

1. Skřivanová, E., Marounek, M., Dlouha, G., and Kaňka, J. 2005. Susceptibility of *Clostridium perfringens* to C2–C18 fatty acids. *Letters in Applied Microbiology*. 41.1: 77-81.
2. Cochrane, R., Huss, A., Aldrich, G., Stark, C., and Jones, C. 2016. Evaluating chemical mitigation of *Salmonella* Typhimurium ATCC 14028 in animal feed ingredients. *Journal of Food Protection*. 79.4: 672-676.
3. Cochrane, R., Dritz, S., Woodworth, J., Huss, A., Stark, C., Saensukjaroenphon, M., DeRouchey, J., Tokach, M., Goodband, R., Bai, J., and Chen, Q. 2016. Assessing the effects of medium chain fatty acids and fat sources on porcine epidemic diarrhea virus viral RNA stability and infectivity. *Kansas Agricultural Experiment Stations Research Reports*. 2.8: 1.
4. Desbois, A. and Smith, V. 2010. Antibacterial free fatty acids: activities, mechanisms of action and biotechnological potential. *Applied Microbiology and Biotechnology*. 85.6: 1629-1642.
5. Choi, M., Kim, S., Lee, N., and Rhee, M. 2013. New decontamination method based on caprylic acid in combination with citric acid or vanillin for eliminating *Cronobacter sakazakii* and *Salmonella enterica* serovar Typhimurium in reconstituted infant formula. *International Journal of Food Microbiology*. 166.3: 499-507.
6. Tsuchido, T., Hiraoka, T., Takano, M., and Shibasaki, I. 1985. Involvement of autolysin in cellular lysis of *Bacillus subtilis* induced by short- and medium-chain fatty acids. *Journal of Bacteriology*. 162.1: 42-46.
7. Papamandjaris, A., MacDougall, D., and Jones, P. 1998. Medium chain fatty acid metabolism and energy expenditure: obesity treatment implications. *Life Sciences*. 62.14: 1203-1215.
8. Zentek, J., Buchheit-Renko, S., Ferrara, F., Vahjen, W., Van Kessel, A., and Pieper, R. 2011. Nutritional and physiological role of medium-chain triglycerides and medium-chain fatty acids in piglets. *Animal Health Research Reviews*. 12.1: 83-93.
9. Whittle, E., Barratt, M., Carter, J., Basketter, D., and Chamberlain, M. 1996. Skin corrosivity potential of fatty acids: In Vitro rat and human skin testing and QSAR studies. *Toxicology in Vitro*. 10: 95-100.
10. Hexanoic acid SDS. <http://www.sciencelab.com/msds.php?msdsId=9927188>. Accessed on May 10, 2018.
11. Decanoic acid SDS. <https://www.caymanchem.com/msdss/20838m.pdf>. Accessed on May 10, 2018.