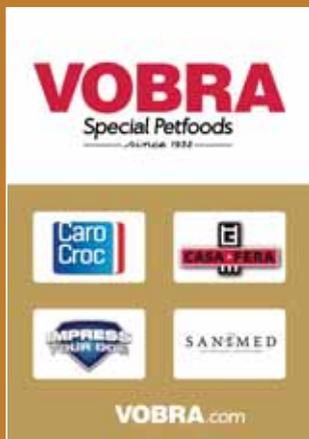




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## Clays in dog foods

*Dog food labels may list ingredients with complicated names, among them clinoptilolite, montmorillonite and bentonite. All three constituents are finely-grained, microporous clay minerals that become plastic when wet. They comprise multi-element complexes with basic structures similar to hardened cement paste. The complexes are found in the earth's crust and can be mined, but analog compounds may be laboratory synthesized.*

*Foods with added clay minerals are purported to enhance gut health, neutralize intestinal toxins, help prevent diarrhea, ameliorate fecal aroma and support joint mobility. On the other hand, the additives are likewise declared, but not highlighted. Their role then is binder for better kibble durability, anticaking agent against kibble lumping or mold-toxin controller.*

*The feces characteristics of healthy dogs reflect the intestine's response to the diet provided. Research data indicate that supplementing the diet with clinoptilolite lowered the daily output of feces by about 6%, while the fecal water content was decreased also. The stools appeared somewhat drier and had less offensive smell. Similar effects were seen in a small-scale study with montmorillonite. For the time being, the claims other than gut health cannot be elucidated with archived observations available in the public domain.*

*Consumption of clinoptilolite by dogs measurably affected feces amount and characteristics. In view of the small size of the effects, poop changes will not be perceivable in many individual dogs. Type and amount of clay minerals determine their effects, if any. Additives bearing the same name often have different compositions. In the event of ambiguity about use purpose, origin, content and efficacy of clay minerals in dog food, owners should contact the manufacturer.*

## Tecto- and phyllosilicates

Tectosilicates constitute three-dimensional frameworks of  $\text{SiO}_4$  tetrahedrons. In tectosilicates of the zeolite group, such as clinoptilolite (CNT), silicon ions are partially replaced by trivalent aluminum, the resulting negative charge being neutralized by various cations. The repeating unit's formula of CNT is represented as  $(\text{Na}, \text{K}, \text{Ca})_{2-3} \text{Al}_3 (\text{Al}, \text{Si})_2 \text{Si}_{13} \text{O}_{36} \cdot 12\text{H}_2\text{O}$ . Phyllosilicates consist of extended sheets of silicate tetrahedrons. One of these compounds, montmorillonite (MMN), forms tetra- and octahedral sheets. Bentonites (BNT) and illites contain MMN to different degrees.

Within the EU, specified preparations of CNT and MMN are authorized for use in dog food as technological additives in the form of binder and anticaking agent. Maximum inclusion levels in food with 12% moisture are 1% for CNT (1) and 2% for BNT and MMN-illite (2, 3).

## Digestive characteristics

Eleven publications are about CNT consumption and indicators of canine digestion (4-14). CNT lowered overall fecal wet weight by 5.8% and fecal moisture fraction by 3.3% units. Net efficiency of dietary dry matter (DDM) digestion fell by 0.7% units and fecal excretion of dry matter rose by 2.4%. The increase in fecal dry matter relates to CNT's indigestibility. The decrease in fresh feces suggests that CNT stimulates intestinal water absorption and/or depresses water intake. CNT intakes ranged from 0.6 to 9% in DDM. Within studies there were no dose-effect relationships. Supplemented or sprinkled food, capsules and snacks acted as CNT vehicles.

CNT feeding made dog stools appear drier: on a scale from 1 (dry, crumbly feces) to 5 (watery diarrhea), the mean score drop was 1 point (5, 14). Simultaneously, the smell was rated less offensive. MMN (2.4% in DDM) increased dry matter digestibility and reduced fecal moisture as analysed chemically or assessed visually; fecal odor was improved (15). The question is whether blinded feces assessments were used throughout.

Diet palatability was not affected by inclusion of CNT (5, 14). CNT-induced changes in average apparent digestibilities of crude protein, fat and nitrogen-free extract were +1.3, +0.4 and -2.3 %units (4-10, 12-14). At identical dietary concentrations, CNT in the coating of extruded kibbles, instead of inside, diminished protein and fat digestibilities (14).

## Diarrhea

German Shepherds fed a commercial diet without or with CNT (3% in DDM) produced shapeless, watery feces or very moist feces with some definite form (11). Ingestion of aluminosilicate clays reduced fecal moisture in healthy dogs (16) and resolved chemotherapy-



induced diarrhea in 10 out of 17 dogs with cancer within three days (17). Finely ground CNT mixed with food (ca 0.3% in DDM) was effective in treating 14 out of 22 dogs with different kinds of cancer (18). CNT (ca 0.1% in DDM) as adjuvant therapy accelerated recovery of dogs with parvoviral enteritis (19).

## Trace elements

Dietary CNT increased the apparent absorption percentages of iron, manganese, copper and zinc (8). Within the digesta, the zeolite possibly had low affinity for the four cations, thereby enhancing their solubility and absorption. Absorption of silicon from a synthetic zeolite was 2.8% (20).

## Toxin adsorption

Urinary excretion of aflatoxin  $\text{M}_1$ , after oral administration of aflatoxin  $\text{B}_1$ , was diminished by kibbled food coated with hydrated sodium calcium aluminosilicate (21). The observation points at the clay binding part of the aflatoxin in the dog's digestive tract.

## Fecal bacteria

Supplemental chabazitic zeolite increased the counts of lactobacilli and bifidobacteria populations in dog feces (22, 23), both bacteria being presumed beneficial. CNT increased fecal lactobacilli but did not influence the number of bifidobacteria (13). The clay alginite left both bacteria unchanged (24).

## Cat study

In cats, different amounts of CNT added to a wet food did not systematically affect feces wet weight and moisture content, but improved fecal texture and odor (25, 26).

*List of references is available on request from the author (beynen@freeler.nl)*

*\* Dr Anton C Beynen writes this exclusive column on dog and cat nutrition every month. He is affiliated with Vobra Special Petfoods.*