

**National Organic Standards Board  
Crops Committee  
Corn Steep Liquor  
Synthetic/Nonsynthetic Determination**

**September 9, 2010**

## **Introduction**

Corn Steep Liquor is a byproduct of the corn wet milling process. This material has been considered non-synthetic in the past by stakeholders including accredited certifying agents (ACAs) and the Organic Materials Review Institute (OMRI). It has been used as a nonsynthetic input mostly in liquid fertilizer formulations for organic crop production. Corn steep liquor was recently reevaluated by OMRI using the NOSB's 2005 clarifications regarding the classification of synthetic and nonsynthetic substances. OMRI concluded that CSL should be classified as synthetic based on the use of sulfur dioxide during processing. A new clarification was passed by the NOSB in November of 2009 which is the clarification that the CC used in their determination.

## **Background**

In an action memorandum dated April 23, 2010, the National Organic Program (NOP) requested that the National Organic Standards Board (NOSB) review the process for corn steep liquor (CLS) concerning its classification as synthetic or nonsynthetic as an input for crop production for the Fall 2010 NOSB meeting. In considering this request, the CC asked the following questions of S&T:

1. Does the change to the molecule occur to any significant degree under the conditions typically found (temp, pH, form of sulfur present, etc.) in the manufacture of this product? What is the classification of this chemical change if there is a change? For example is it breaking the bond so the protein goes from insoluble to soluble? Is the physical orientation changed versus the chemical structure in terms of molecules – the name of the chemical formula is identical but the rotation is changed?
2. If so (and only if so), does the physical re-orientation of the atoms in the bond constitute a **chemical** change, or merely a structural change with no change in chemistry?
3. What other materials made from this process that are currently on the National List would be effected if we determine that this process causes a chemical change sufficient to be designated synthetic? And in addition to that, what products that are currently on the list that use these materials would be affected? (i.e. liquid fertilizers that use Corn Steep Liquor and other materials like starch that may be used in fertilizer or pesticide formulations)
4. Can CSL be made without the use of prohibited substances? Are there other materials that are more benign that can be used to make CSL?

5. Are there other permitted materials that could be used instead of CSL in its current use?

The Technical Review received in February of 2010, while not answering these questions directly, was deemed adequate to go forward with discussions of synthetic/non-synthetic determination for CSL. This determination was discussed over the course of a number of CC weekly meetings.

### Relevant areas in the Rule

In crop production, nonsynthetic substances are allowed unless listed on the NL §205.602, while synthetic substances are prohibited unless listed on the NL §205.601.

OFPA defines **Synthetic** is defined as “a substance that is formulated or manufactured by a chemical process or by a process that chemically changes a substance extracted from a naturally occurring plant, animal, or mineral sources, except that such term shall not apply to substances created by naturally occurring biological processes” (§2103 (21)) and

**Nonsynthetic (natural)** is defined as “a substance that is derived from mineral, plant, or animal matter and does not undergo a synthetic process as defined in section 6502 (21) of the Act (7 U.S.C. 6502(21)). For the purposes of this part, nonsynthetic is used as a synonym for natural as the term used in the Act” (§205.2 Terms defined).

Chemical change is defined by the November 2009 recommendation as “an occurrence whereby the identity of a substance is modified, such that the resulting substance possesses a different distinct identity (see related definition of “substance”). As discussed by the MWG in their recommendation, chemical change is “an event in which one substance becomes one or more difference substances.” Chemical change would not necessarily include processes like ion-exchange or pH adjustment if the final material was not a different substance from the initial substance. For clarity, a definition of substance is included in the recommendation as well: Substance An element, molecular species, or chemical compound that possesses a distinct identity (e.g., having a separate Chemical Abstract Service (CAS) number, Codex International Numbering System (INS) number, or FDA or other agency standard of identity).

### Discussion

The CC voted to classify CSL as synthetic based on the use of a non-allowed synthetic; sulfur dioxide, in the corn wet milling process. The majority of the CC felt that the sulfur dioxide use broke disulfide bonds during the steeping process prior to the lactic acid fermentation and that a significant amount of sulfur dioxide remained in the final product. The consensus of the majority was that any non-allowed synthetic used in the process of manufacturing a material makes that material synthetic. By this determination, other products of the wet corn milling process would also have to be reassessed as to their synthetic/nonsynthetic determination as well as other input into organic crop production.

## Recommendation

The Crops Committee recommends that Corn Steep Liquor produced with synthetic materials not allowed for organic processing such as sulfur dioxide be classified as a synthetic.

## Committee Vote

Motion: Consider CSL to be synthetic

Motion: Jeff Moyer                      Second: Kevin Engelbert

Yes: 4                      No: 2                      Abstain: 0                      Absent: 1

## Minority opinion

This minority opinion argues that the NOSB should determine Corn Steep Liquor (CSL) to remain classified as nonsynthetic. Such a decision would allow its continued use as an input to liquid fertilizers common in organic crop production systems.

### 1. Identity of CSL is unchanged by use of SO<sub>2</sub> as a pH buffering processing aid.

First and foremost, after many years of careful deliberation by the Materials Working Group, the NOSB, the NOP, and many interested individuals in the organic community and industry, the following definition of chemical change was adopted by a supermajority of the NOSB in April 2010 through discussion of Classification of Materials:

Chemical Change--An occurrence whereby the identity of a substance is modified, such that the resulting substance possesses a different distinct identity (see related definition of "substance")

The minority understands that some in the majority disagree with the definition adopted by the NOSB in April, but to disregard the definition adopted under due process in one's analysis is inappropriate. In deliberations of the Crops Committee, only the minority referenced the linchpin of identity in its decision making process. The vocal majority voiced the leading rationale that a material's contact with a synthetic renders the whole material synthetic. The minority considers this rationale to be inaccurate, inconsistent, and unrealistic.

There was no evidence indicating that that the identity—that which makes the subject in question unique in its behavior, character, or function—of corn steep liquor as used is any different with or without SO<sub>2</sub> as a processing aid. The behavior, character and function of the two are indistinguishable and on that basis alone, CSL remains non-synthetic.

Corn starch has previously been accepted by NOSB, using the exact same steeping process as CSL. In the 1995 TAP Review for native cornstarch, reviewer Richard Theuer stated that "sulfur dioxide is used as a 'temporary' preservative to avoid putrefaction of soaked corn. Later, fermentation inhibits putrefactive organisms." Dr. Theuer's recommendation was that cornstarch be classified as nonsynthetic. That same year, the NOSB determined that the SO<sub>2</sub> used in corn starch production was a processing aid. Synthetic processing aids used in food

have not been determined to render agricultural products synthetic. If CSL was to be considered synthetic, then this decision would contradict how a handling material is listed on the National List.

CSL has a long history of safe use as an added source of nutrition in animal feed, in fermentation processes, and in antibiotic production. It is not a significant source of water or air pollution. Due to the fact that CSL is composed of proteins, amino acids, carbohydrates, organic acids (such as lactic acid), vitamins, minerals and water, no environmental contamination would be expected. These components are all readily utilized by animals and microorganisms. In fact, CSL is a nutrient rich product that has been safely used as a component in livestock feed, fertilizers, and soil conditioners for many years.

Furthermore, if the proposal that CSL should be considered to be synthetic is attributed to the sulfur dioxide used as a processing aid in the corn wet milling process, one should note that it is generally agreed that the SO<sub>2</sub> action occurs in the endosperm protein matrix of the corn kernel, not in the steepwater. There is compelling evidence that the proteins that the SO<sub>2</sub> allegedly alters are insoluble, thus are not a part of the CSL. The level of SO<sub>2</sub> remaining in the final CSL product is insignificant. General analysis of corn steep liquor reports the SO<sub>2</sub> in CSL from 0.0009 – 0.015 (Liggett and Koffler, 1948). For use in organic crop production, the CSL is typically blended with other approved materials or used as a compost feedstock, which would further reduce the already insignificant levels of SO<sub>2</sub> to be non-detectable.

#### *Inconsistent technical opinion*

Many inconsistencies exist in the technical documentation regarding the roles that sulfur dioxide (SO<sub>2</sub>) and lactic acid play during the corn wet milling process.

One of the most common claims—claims that precipitated the NOP request for the NOSB to review this material at all—is that the starch is released from the protein matrix due to the addition of SO<sub>2</sub>, disrupting the disulfide cross-links. Several technical papers accept this, the majority citing Watson, 1984 as their reference.

However, there is also compelling documentation that the protein matrix is broken down not by SO<sub>2</sub>, but by lactic acid or endogenous enzymatic action. In these cases, the function of the SO<sub>2</sub> is not to break the disulfide bonds, but to prevent the growth of putrefactive microorganisms and to activate proteases already present in the kernels.

The corn wet milling process is not well understood. This is evidenced by the contradictory findings and summaries of the various scientific studies and technical papers that are currently available, and specifically noted by the Technical Evaluation Report Compiled by the Technical Services Branch for the USDA National Organic Program. With respect to the wet milling process, it confirms in lines 192 and 193 that “It is a complicated process of chemical and biochemical reactions that, despite the long history of the wet-milling industry, are still not fully understood.” This is far from conclusive or even suspicious.

## **2. Majority rationale runs counter to past precedent and common sense, blurring the lines between classification and allowability**

Wheat grass may be used as an input to an organic farm, regardless of whether it was produced organically or otherwise; its non synthetic status is not in question and likely has far more notorious residues on it than a trace amount of sulfur. That same wheat grass may not be used to make organic wheat grass juice or fed to organic livestock because the wheat grass is not organic, but that is an issue of allowability, not of classification. Even conventional wheat grass is non-synthetic.

Sugar and molasses are produced with allowed synthetic inputs and processing aids ( e.g. calcium hydroxide, CO<sub>2</sub>, ion exchange resins, etc.) and never are those considered synthetic. Organic sugar is produced with calcium hydroxide and is clarified with ion exchange technology that exposes it to synthetic resins, but we do not consider organic sugar synthetic, regardless of whether that sugar is added to a fertilizer, added to a feed mix, or to organic cookie dough. The majority opinion's rationale fails on this point.

Organic fruits and vegetables are frequently dumped into chlorinated water in most pack sheds and many processors. Is this produce considered synthetic because of this contact with a synthetic processing aid? Of course not; the majority opinion's rationale fails on this point. If the rinds and skins are synthetic, then they would cease being able to be given to organic livestock operations for feed or to compost manufacturers because they would be synthetic inputs that would lead to decertification of livestock or would turn all compost made with them to synthetic compost.

Newspapers are considered synthetic under the NOP, yet they are allowed to be used in the manufacturing of compost for organic farms. The newspapers are considered synthetic, yet the compost is not (otherwise that compost would not be allowed on an organic farm). Again, the majority opinion's rationale fails on this point.

There are hundreds more examples to be found in this regard. As an organic community, we have already made this decision, and the minority opinion argues, have made it correctly. If that were the case, if the majority rationale carries the day, then the vast majority of organic farm inputs derived from agricultural by products would be lost to use by organic farms.

### **A closing comment**

The purpose of soaking corn in water is to soften corn kernels so that starch can be separated from protein in order to further process the corn into other products including oil, cornstarch and corn gluten. Corn steep liquor (CSL) is a food waste from the corn wet milling process and contains an insignificant amount of the processing aid, sulfur dioxide or SO<sub>2</sub>, and includes other plant nutrients derived only from what was in the corn to begin with.

CSL was classified as a non-synthetic input in the fertilizer manufacturing community since well before the advent of the NOP. OMRI's sudden reversal of its assessment occurred without the benefit of the NOSB's definition of chemical change approved in April of 2010, which is provided below, and, in the minority opinion's view, has blurred the lines of classification and allowability.

CSL is not presently applied to crops or soil directly. It is blended with other natural ingredients in liquid fertilizer formulations and may be used as a feedstock in compost. Both uses further reduce the already insignificant amount of the processing aid, sulfur dioxide or SO<sub>2</sub>. The resulting fertilizer products are not harmful to soil or micro-organisms and provide nutrient rich material; and it is not used to supply sulfur to soil or crops. This fertilizer, like all other plant derived, simply processed crop by products contain numerous nutrients and other beneficial natural compounds.

The action of the SO<sub>2</sub> in the countercurrent (traditional) corn wet milling process does not render CSL synthetic; the SO<sub>2</sub> provides a buffering action to allow lactic acid fermentation to triumph over putrefaction.

## Definitions

**Chemical Change**--An occurrence whereby the identity of a substance is modified, such that the resulting substance possesses a different distinct identity (see related definition of "substance")

**Substance**--An element, molecular species, or chemical compound that possesses a distinct identity (For example, a distinct identity may be demonstrated through the material having a separate Chemical Abstract Service (CAS) number (in some cases the same material may have multiple CAS numbers), Codex International Numbering System (INS) number, or FDA or other agency standard of identity).

**Nonsynthetic (natural)**--A substance that is derived from mineral, plant, or animal matter and does not undergo a synthetic process as defined in section 6502(21) of the Act (7 U.S.C. 6502(21)). For the purposes of this part, Nonsynthetic is used as a synonym for natural as the term is used in the Act.

**Synthetic**--A substance that is formulated or manufactured by a chemical process or by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral sources, except that such term shall not apply to substances created by naturally occurring biological processes.

**Processing aid.** (1) Substance that is added to a food during the processing of such food but is removed in some manner from the food before it is packaged in its finished form;  
(2) a substance that is added to a food during processing, is converted into constituents normally present in the food, and does not significantly increase the amount of the constituents naturally found in the food; and  
(3) a substance that is added to a food for its technical or functional effect in the processing but is present in the finished food at insignificant levels and does not have any technical or functional effect in that food.

Minority opinion: John Foster and Tina Ellor