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ALOE VERA
INFORMATION SERVICES

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## The Crucial Importance of Correct Processing

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The all-important biomedical activities of aloe juices and extracts depend critically upon applying strict rules of processing and handling. These determine whether or not the labile biochemicals in the living plant are successfully stabilised during manufacture and, subsequently, during distribution and storage.

This newsletter reviews this important aspect of Aloe.

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## Introduction

Getting oneself supplied with good Aloe vera Extract is not so easy as one might think. One problem is that the Aloe Industry has been very prone, unfortunately, to misleading practices, with suppliers often diluting the valuable Aloe Extracts with water to increase their profits - even to the extent of selling virtually pure water as Aloe. In other cases suppliers have extended the extracts with a combination of water and maltodextrin - a cheap carbohydrate product from corn starch - just to make it look as though the solids component of the Aloe has not been diluted. That is one of the problems with Aloe and it will be dealt with fully in Newsletter No 11.

The other major obstacle to getting really genuine Aloe does not relate to dishonesty, but rather to lack of knowledge or a lack of tightness of management control in the Aloe processing operations. The problem is that many of the active ingredients of Aloe are distinctly labile, that is to say, that if you subject them to even slightly adverse conditions, then they spontaneously undergo chemical changes which cause them to lose the biomedical activity, which is what the purchaser of Aloe is trying to buy.

## The Active Principles of Aloe and their Survival of Processing

The known active principles of Aloe are (1) Plant sterols (2) Natural salicylates (3) The enzyme bradykininase (4) A probable unknown antihistamine substance (5) Plant hormones of the group known as auxins (6) Plant hormones of the group known as gibberellins (7) The special carbohydrate of Aloe, known as "glucomannan", which in reality represents several active principles, because it comprises fractions of different molecular weights which have different effects. These active principles have been discussed already in Issues 1, 2 and 4.

It is clear that these various active principles have differing degrees of lability, i.e. will vary in their susceptibility to inactivation under conditions of processing. Indeed, since they are of a number of widely differing chemical types we can be sure that some types of processing operation will adversely affect one active principle and another type of processing operation will adversely affect different active principles. This makes the problem complex, because different parts or aspects of the product become vulnerable at different stages of the processing operations.

## The Steps in Aloe Processing and the Vulnerability of Biomedical Activity

When we come to consider the steps in processing we have to consider that there are two main products involved, either gel or whole leaf extract, and that different processing steps are needed for each of these products. However, they both begin in the same way, with harvesting the leaves and transport off the field to a place where the first steps of processing are carried out. Usually there will also be a holding period when the delivered leaves are awaiting processing. What is important here is (1) the time taken from the moment of cutting to reaching storage (2) the conditions under which the leaves are transported from the field to the plant (3) the conditions of storage during the holding time, especially whether these involve cold storage.

Large American producers of Aloe vera have done work monitoring the changes in biological activity with time and holding conditions. They have shown that there is significant loss of activity if the cut leaves are kept at ambient temperature for more than 6 hours after harvest and that if the leaves are kept beyond that time, then the level of activity goes on falling and reaches zero after about 24 hours. They found that although cold storage slows the rate of loss of activity, it cannot prevent it altogether. All this means that the leaves, after being gathered from the field, should be transported into cold storage as quickly as possible, preferably well under the six hours required for deterioration to start, and should be kept cold. Processing should begin as soon as possible, i.e., holding times should always be minimized. Moreover, the processing should also be completed as quickly as possible. A guideline has been suggested that the overall time from cutting to the completion of processing should not exceed 36 hours, even when cold storage is employed. Obviously, these criteria put certain pressures upon process operators. Meeting these criteria calls for well organised logistics and careful management and if these are not provided then standards can slip and product of a lower grade will be turned out. The deterioration which occurs will be partly through spontaneous decomposition but is has also been shown that in the cut leaf, upon standing, enzymes within the cut leaves remain active and start to reduce the concentration of active principles. Clearly then, a careless processor could quite easily completely destroy the biomedical activity of his Aloe before even starting to process it.

## The Processing Sequence

As soon as processing starts, the leaf must be designated either for gel or for whole leaf extract. If it is for gel the leaf will be cut to dissect the central gel from the outer rind. This may be done either by hand cutting or by machinery. Obviously, the hand and mechanical versions of the process cannot be exactly the same. The machine extraction of the gel is bound to be just a little more "hit or miss" and as a result the gel extracted by this method usually contains rather more of the exudate materials (e.g. aloin), than hand dissected gel. If the leaf is to be for whole leaf extract, then it is ground up in a mill without any previous dissection. After these processes, the clear juice has yet to be obtained. In the case of the gel this involves only grinding the gel tissue, which then disintegrates to yield mostly fluid with a little fibre floating in it. The gel is of such a high water content that it converts mainly into liquid. Some manufacturers remove the floating fibre, but others do not, since it contains some of the activity of the original gel and might as well be consumed with the liquid. In the case of the whole leaf, the extract has to be expressed from the mass of fibrous leaf fragments under pressure. This is actually quite hard to do because there is so much fibre relative to the quantity of free liquid available. Thereafter the extract must be passed on to a chiller to reduce its temperature. These steps are illustrated in Figure 1.

## Leaf Breakdown and Cellulase Enzyme

The process of disintegrating the whole leaf has to be watched quite closely. Firstly, in a poorly controlled operation it would be easy for the milling to raise the temperature significantly. The Aloe leaf is tough and fibrous. Plenty of energy has to be used to break it down to fine fragments. Such mechanical energy becomes dissipated as heat. Secondly, the separation of the liquid extract from the pulp, because there is so much fibre, is almost impossible unless a processing aid is added. The processing aid is the enzyme cellulase, which is capable of breaking down some of the cellulose fibre, and this makes separation of the liquid a great deal easier. There is a price to be paid, however, because the cellulase is also capable of breaking down the glucomannan constituent of Aloe which is such a key active principle for its biological activity. As to whether or not any detrimental breakdown of valuable glucomannan occurs, is dependent upon the length of time for which the Aloe is exposed to the effects of active cellulase and the amount of cellulase enzyme used. If excess cellulase is used, or if the active enzyme is left too long in contact with the Aloe, then very detrimental breakdown of the glucomannan may occur. Once again it is a matter of controlling carefully the time and conditions of contact between the Aloe and the enzyme. The cellulase should not be regarded as being *inevitably harmful*, for it is not. The glucomannan, as was stated above, occurs in different versions, and any sample of Aloe will contain a cross-section of glucomannans having different molecular weights (for the non chemist, this can be regarded as being much the same as molecules of different *sizes*). The cellulase can

*Figure 1*

**Pre-Processing Flow**