

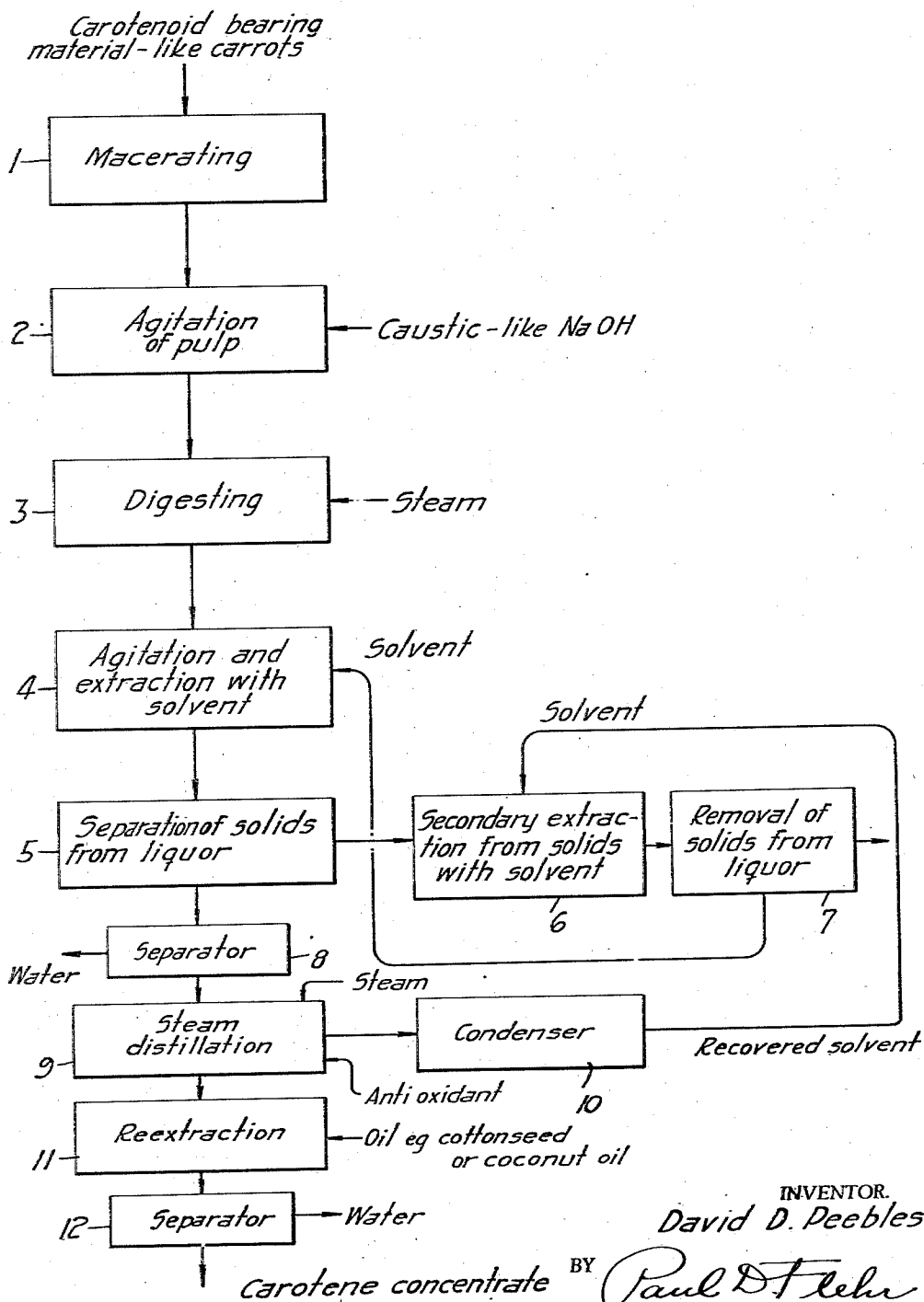
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PROCESS FOR EXTRACTING CAROTINOIDS

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PROCESS FOR EXTRACTING CAROTINOIDS

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This invention relates generally to the extraction of vitamin values from carotinoid bearing materials such as fresh vegetables or greens. By vitamin values I have reference particularly to carotene, as well as to other fat soluble vitamins and provitamins which may be contained in the material being treated.

It is an object of the invention to provide a process of the above character which will make possible manufacture of vitamin concentrates at relatively low cost, and with a minimum amount of plant equipment.

It is a further object of the invention to provide a vitamin extracting process which will be characterized by a relatively high percentage yield of the desired carotenes.

Further objects of the invention will appear from the following description in which the preferred embodiment of the present invention has been described in detail in conjunction with the accompanying flow sheet.

In the past, processes for the extraction of carotenes from various vegetables or like carotinoid bearing materials, have utilized direct extraction of the carotene by the use of a hydrocarbon solvent. In some instances the solvent has been contacted with juices expressed from the vegetable material, and in other instances the vegetable material is first dried, and then contacted with a solvent. Both of these processes are relatively inefficient with respect to the percentage of carotene recovered in the final product. Where drying is employed prior to the extraction operation, in order to reduce the bulk of material to be treated, the extraction is apt to be inefficient, due to impairment of the carotene during the drying operation, and also due to the manner in which the carotene is held with the fibrous or cellular material. Furthermore, dehydrating operations are relatively expensive and require elaborate plant equipment.

The present process deviates from prior practice in that the carotinoid bearing material is first subjected to a digesting operation, to break down the cellular structure of the material, before the extraction operation. It has been found that such a digesting operation can be carried out without material injury to the carotene content, and that it enables relatively efficient extraction.

In commercial operations my process can be carried out as follows:—A suitable carotinoid bearing material, such as fresh carrots, is first subjected to a grinding or macerating operation to form a wet ground mass. Preparatory to

carrying out the digesting operation, a suitable caustic, such as sodium hydroxide is introduced into the ground mass of material, as indicated at 2. While the process is not critical with respect to the amount of caustic employed, good results are secured by employing an amount of sodium hydroxide equal to about 5% of the weight of the original carrots.

The alkaline mass is now subjected to a digesting operation 3, in which it is heated to an elevated temperature. This can be accomplished by the use of a suitable closed digester, within introduction of steam into the digester at a suitable pressure, such as about 100 pounds per square inch. The time required to effect a proper degree of digestion will depend somewhat upon the type of material being treated, but with carrots a period of about fifteen to thirty minutes will suffice. The resulting digested material is a slurry containing pulp like material, and can be readily blown out of the digester, for subsequent treatment.

The digested material is then subjected to an extracting operation 4, which can be carried out by the use of a solvent which can be removed by evaporation or steam distillation, such as a petroleum ether, heptane, or a petroleum solvent known as mineral spirits, which consists of a mixture of petroleum fractions intermediate with respect to kerosene and gasoline. The solvent is introduced with agitation, in order to secure a thorough intermingling such as will enable efficient extraction of carotene by the solvent. This mixture is then subjected to a separating operation 5, for the removal of solids. This operation can be carried out by methods of gravity settling and decantation, or by the use of a centrifugal separator. In order to increase the efficiency of extraction, the solids thus removed can be further extracted in progressive operations, until substantially all of the residual carotene has been removed. For example in operation 6 the solids removed in the operation 5 are shown being remixed with a solvent, with solids being again removed from the mixture at 7. Solvent removed from the operation 7 is shown being utilized in the primary extracting operation 4.

After removal of solids at 5, the liquor consists of hydrocarbon solvent, together with water, and possibly a certain amount of emulsion. This mixture of solvent and water may then be subjected to a further separating operation 8, which can be carried out by the use of a suitable centrifuge, with or without heating, for removing a majority of the water and for breaking down any

emulsion which may be formed. The resulting solvent is then subjected to steam distillation operation 9. Before all of the solvent has been removed by distillation it is desirable to introduce a suitable antioxidant, like hydroquinone, into the remaining material, in order to protect the carotene against oxidation. After the solvent has been entirely removed there remains an aqueous material in which the carotene is suspended, together with other vitamin values if present, which were extracted by the solvent. This aqueous material is then mixed with a suitable oil, like coconut, sardine, or cottonseed oil, as indicated at 11, whereby carotenes and other fat soluble vitamin values are extracted and dissolved by the oil. This admixture is then subjected to a separating operation 12, which can be carried out by a suitable centrifuge, to remove the water.

The carotene concentrate obtained as described above forms a marketable product, suitable for many purposes. For example, it can be used to fortify vitamin values contained in various food materials, such as milk products, or to supply a desired carotene content for other vitamin containing materials.

With respect to the efficiency of my process, it makes possible recovery of about 90% of the carotene contained in the material being treated. This high percentage of recovery is attributed largely to the digesting operation, which makes the material amenable to efficient extraction. With my process, large scale production of carotene concentrates at low cost is made possible, not only because of the high efficiency, but also because relatively inexpensive plant equipment is required, with relatively low operating and maintenance costs.

I claim:

1. In a process for extracting carotinoids from cellular carotinoid-bearing materials, macerating

the material, breaking down the cellular material by digesting the macerated material with alkali at a pressure substantially greater than atmospheric and a temperature substantially greater than 212° F., rapidly releasing the pressure upon said material, and then subjecting the digested material to solvent extraction for removal of carotinoids.

2. In a process for extracting carotinoids from carotinoid-bearing materials, said process being characterized by the use of a closed digesting chamber adapted to receive a charge of material and capable of withstanding considerable internal pressure, said method comprising macerating the material and introducing a caustic into the same, introducing the macerated material into said chamber, introducing steam under pressure into the interior of the chamber whereby the material is digested at an elevated temperature in excess of 212° F. and at a pressure substantially greater than atmospheric, causing the digested material to be blown from said chamber, and then subjecting the digested material to solvent extraction for removal of carotinoids.

3. In a process for extracting carotinoids from materials like fresh vegetables or greens, mechanically crushing the material to form a wet divided mass, introducing a caustic into the wet divided mass whereby the mass is rendered alkaline, subjecting the alkaline mass to the action of steam under pressure whereby the material is digested without contact with air, the digesting operation being of relatively short duration, comparable to the practice of subjecting the material to a steam bath for a period of time from about fifteen to thirty minutes at a pressure of about one hundred pounds per square inch, releasing the pressure upon the material, and then removing carotinoids from the digested material by solvent extraction.

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