

This invention relates to a process for the production of soluble instant coffee in powder form.

5 Soluble coffee powder is conventionally produced by freeze-drying or spray-drying after evaporation of a coffee extract obtained by the percolation of an extraction liquid through cells filled with ground roasted coffee (Sivetz, Coffee Processing Technology, Volume 1, pages 262, 263, AVI, 1963).

10 Extraction is carried out in countercurrent, i.e. the water under pressure at a temperature of 150 to 180°C is introduced into the cell containing the batch of ground roasted coffee which has been most intensively extracted (having undergone N extractions) at the bottom of that cell. The liquid extract of this extraction cell is then
15 passed through the extraction cell containing the batch of coffee which has been extracted (N-1) times and so on until the liquid extract passes through the cell which has just been filled with fresh ground roasted coffee.

20 The final extract leaves this last cell at a temperature of the order of 100°C.

The most intensively extracted coffee is thus subjected to the highest temperature while the fresh coffee is subjected to the lowest temperature.

25 A distinction is normally drawn between the pressure stage, which is also known as the autoclave section and which consists of cells containing the most intensively extracted coffee, and the atmospheric stage which consists of cells containing the least intensively extracted coffee.

30 After each extraction cycle, the cell containing the most intensively extracted coffee is emptied, filled with fresh coffee and, after the cells have been suitably interconnected, another extraction cycle begins.

Accordingly, only one extraction liquid is used in this conventional extraction process.

35 In another process known as split extraction, two

extraction liquids are used, the extraction cells being divided into a pressure stage and an atmospheric stage. Each stage is extracted with its own extraction liquid.

5 The coffee in the atmospheric stage is extracted with a first extraction liquid under moderate temperature and pressure conditions while the coffee in the pressure stage is extracted with a second extraction liquid under much higher temperature and pressure conditions.

10 EP 0 352 842 describes a process of this type in which the extract from the atmospheric stage is concentrated to a dry matter content of around 40% by cryoconcentration or reverse osmosis or by evaporation after stripping with steam and condensation of the volatile aromas which are then reintroduced into the concentrated extract, the
15 extract from the pressure stage is concentrated by evaporation to a dry matter content of around 40%, the two extracts are mixed and the mixture is frozen and/or freeze-dried.

20 Another process of this type is described, for example, in Pintauro, Coffee Solubilization, pp. 41,42, Noyes Data Corporation, 1975, and in US-PS 3,790,689.

Two different liquid extracts are thus produced and, after partial evaporation of the extract from the pressure stage, may be combined with one another and subsequently
25 converted into powder form by conventional processes, for example by spray drying or freeze drying.

It is possible by this process to obtain a coffee having distinctly improved organoleptic qualities, in particular by virtue of the fact that the extraction liquid
30 of the atmospheric stage is free from compounds extracted in the pressure stage.

In the process according to US-PS 3,790,689, the extract from the atmospheric stage is not subjected to split evaporation whereas the extract from the pressure
35 stage undergoes evaporation to bring its dry matter content

to around 50%. The two extracts are then mixed to produce a final extract having a dry matter content of around 25%. The extract obtained is then concentrated by evaporation before being converted into powder form. During this evaporation step, the volatile compounds emanating from the extracts of the atmospheric stage and the pressure stage are lost. This is beneficial in the case of the volatile compounds from the pressure stage which are known to be the cause of unpleasant organoleptic characteristics of the end product. By contrast, this loss is penalizing in the case of the volatile compounds in the extract from the atmospheric stage which are responsible for agreeable organoleptic characteristics.

Various attempts have been made to produce a final extract after mixing which has a dry matter content of, or even exceeding, 30%, particularly with a view to reducing the amount of energy required for the final evaporation step before freeze drying or spray drying to bring the extract to a dry matter content of around 40% by weight or higher.

Unfortunately, all these attempts have been confronted by a problem which, in fact was already present in the process described in US-PS 3,790,689.

To be able to obtain a final mixture having the highest possible concentration, it is obviously necessary to subject each of the two extracts produced to an evaporation treatment.

Unfortunately, this involves two conflicting requirements. Firstly, excessive evaporation of the extract from the pressure stage results in blockage of the evaporators due to the particular composition of the extract. This is because, when it is desired to bring this extract to a concentration above 25% by weight, insoluble compounds appear in large quantities - increasing very rapidly with the concentration - so that the evaporator is blocked and

the process becomes unworkable on an industrial scale.

Secondly, this limitation of the evaporation of the extract from the pressure stage cannot be compensated by an increase in the evaporation of the extract from the atmospheric stage. The reason for this is that the extract from the atmospheric stage must not undergo excessive evaporation due to the loss of aromas this would involve. Unlike those in the extract from the pressure stage, the aromas in the atmospheric stage extract must be preserved at all costs.

It is for this reason that the process of split extraction has not yet been the subject of any real industrial development.

Accordingly the object of the present invention was to solve this problem.

Now, it has been found that, under certain conditions, it is possible to evaporate the extract from the atmospheric stage to a dry matter concentration of 40% by weight and only to evaporate the extract from the pressure stage to a dry matter concentration of around 20% by weight, so that a mixture is obtained which has a dry matter concentration in excess of 30% by weight and which may then be concentrated by evaporation and converted into powder form by any known process.

This is because the aroma-charged vapours produced by evaporation of the extract from the atmospheric stage can be recovered and condensed and the condensate can be concentrated by any known process, for example by cryo-concentration or by reverse osmosis.

The concentrate obtained may then be reintroduced, for example, into the liquid extract just before it is converted into powder form. It may also be contacted with an oil which fixes the aromas and which is then sprayed onto the coffee powder by a known process.

Accordingly, the present invention relates to a

process for the production of soluble instant coffee in powder form by split extraction of ground roasted coffee in percolation cells to produce a first liquid extract from the atmospheric stage and a second liquid extract from the pressure stage, the first liquid extract then being evaporated to a dry matter concentration above 35% by weight and the second liquid extract being evaporated to a dry matter concentration below 25% by weight, the two liquid extracts then being mixed, the mixture of the two liquid extracts being concentrated by evaporation to bring its dry matter content to more than 40% by weight the evaporation vapours of the first liquid extract being condensed and concentrated and the concentrate obtained being reintroduced into the mixture of the two liquid extracts after evaporation thereof.

Other features and advantages will become apparent from the following description in conjunction with Fig. 1 which is provided purely by way of example and which illustrates an installation for carrying out the process.

As shown in Fig. 1, an extraction installation consists of several, preferably six, percolation cells which are charged with ground roasted coffee and which are interconnected by a suitable system of pipes. The extraction installation is divided into a first group of cells forming the atmospheric stage 1 and a second group of cells forming the pressure stage 2, the atmospheric stage 1 being supplied with extraction liquid through a pipe 11 and the liquid extract produced being removed through a pipe 12. Similarly, the pressure stage 2 has a feed pipe 21 and a discharge pipe 22.

A heater 3 may be provided at the exit of the atmospheric stage 1 to heat the liquid extract to a temperature of 95 to 98°C. The heated liquid extract may then be subjected to stripping with steam in a column 4, for example a plate column.

In this stripping phase, the liquid extract descends in countercurrent to an ascending flow of steam. The volatile compounds are entrained by the steam and are recovered by condensation of the steam without undergoing any of the aggressive heat effects produced by the subsequent evaporation treatments.

The liquid extract then passes into an evaporator 5 equipped with means 6 for condensing and concentrating the vapours produced, for example by cryoconcentration or reverse osmosis.

During this evaporation step, the dry matter content of the extract increases to more than 35% by weight. There is in fact no real limit to this concentration by evaporation. However, it has been found that, if the dry matter content reaches 50% by weight, the extract becomes too viscous to be able to be readily mixed thereafter with the extract from the pressure stage 2.

Similarly, at the exit of the pressure stage 2, the liquid extract enters an evaporator 7.

During this operation, the dry matter content of the extract from the pressure stage 2 is brought to 15 - 25% by weight and preferably to around 20% by weight.

The liquid extracts from the evaporators 5 and 7 are then mixed in a mixer 8 and the mixture obtained is re-evaporated in an evaporator 9 to bring its dry matter content to around 40 - 45% by weight. There is in fact no real limit to this evaporation which is determined by the operating parameters of the installation for converting the extract into powder form.

The dry matter content of the extract from the atmospheric stage is preferably brought to around 40% by weight. There is in effect no need to subject the liquid extract from the atmospheric stage to an evaporation treatment which will bring its dry matter content into the vicinity of the dry matter content of the final mixture which is

necessary for converting this mixture into powder form. More particularly, since the concentrated liquid extract from the atmospheric stage 1 is diluted in the concentrated liquid extract from the pressure stage 2, it is preferable
5 not to subject this liquid extract from the atmospheric stage to two evaporation treatments which would take its dry matter content beyond 40% by weight.

Surprisingly, although it is not possible for the reasons explained above to concentrate the extract from the
10 pressure stage 2 by evaporation to a dry matter content above 25% by weight, it is readily possible to concentrate the mixture of extracts from the atmospheric and pressure stages to more than 40%. Although not a definitive explanation, it would seem that this is due to the particular
15 compounds present in the extract from the atmospheric stage which inhibit the formation of insoluble components from the compounds present in the extract from the pressure stage.

It is at the exit of the evaporator 9 that the concentrated evaporation condensate produced by the means 6 and
20 the steam stripping product obtained in the column 4 are introduced into the final liquid extract before this extract is converted into powder form in a unit 10, for example a freeze-drying installation or a spray drying
25 tower.

The following Table illustrates the application of the process according to the invention.

During these tests, the influence of the ratio R (weight of extract per cycle/weight of coffee per cell),
30 also known as the draw-off, was tested for each of the extracts produced by the atmospheric and pressure stages. Similarly, the dry matter content Tc of the extracts before and after evaporation was measured, as was the dry matter content of the final mixture before evaporation and after
35 evaporation before its conversion into powder form.

In this Table, the extract from the atmospheric stage is referred to as EF and the extract from the pressure stage as EC.

	R	Tc (%)	Tc after evaporation (%)	Tc of mixture (%)	Tc of mixture after evaporation (%)
EF	5.0	5.6	41.3	31.0	43.3
EC	3.0	4.9	21.0		
EF	5.0	5.5	41.0	29.5	44.3
EC	3.7	4.4	21.0		
EF	5.0	5.6	41.0	26.2	43.2
EC	5.0	3.2	16.0		
EF	3.2	8.4	40.0	29.6	45.7
EC	4.5	3.8	21.0		
EF	1.0	16.4	40.0	25.5	45.3
EC	4.5	6.1	21.0		
EF	1.0	17.1	40.0	25.5	37.7
EC	6.0	4.8	19.5		
EF	2.0	9.6	40.0	25.5	45.6
EC	6.0	3.2	18.5		
EF	2.5	10.2	40.0	33.1	47.6
EC	4.0	4.0	18.5		
EF	3.5	7.7	40.0	25.5	47.2
EC	6.0	3.3	17.0		

It can clearly be seen that it is possible by the process according to the invention to obtain a final extract having a dry matter content above 40% by weight obtained by split extraction in which the extract from the pressure stage is concentrated to a dry matter content of only around 20% by weight while the extract from the atmospheric stage is concentrated to a dry matter content of around 40% by weight without any denaturing of the atmospheric stage extract, of which the volatile compounds were recovered before the evaporation treatments and reintroduced thereafter while the volatile compounds in the extract from the pressure stage are eliminated.

CLAIMS

1. A process for the production of soluble instant coffee in powder form by split extraction of ground roasted coffee in percolation cells to produce a first liquid extract from the atmospheric stage and a second liquid extract from the pressure stage, the first liquid extract then being evaporated to a dry matter concentration above 35% by weight and the second liquid extract being evaporated to a dry matter concentration below 25% by weight, the two liquid extracts then being mixed, the mixture of the two liquid extracts being concentrated by evaporation to bring its dry matter content to more than 40% by weight the evaporation vapours of the first liquid extract being condensed and concentrated and the concentrate obtained being reintroduced into the mixture of the two liquid extracts after evaporation thereof.
2. A process as claimed in claim 1, in which the first liquid extract is concentrated to a dry matter content of 40% by weight.
3. A process as claimed in claim 1, in which the first liquid extract, on leaving the atmospheric stage and before concentration by evaporation, is subjected to stripping with steam, the steam obtained being condensed and reintroduced into the mixture of the two liquid extracts after evaporation of this mixture.

