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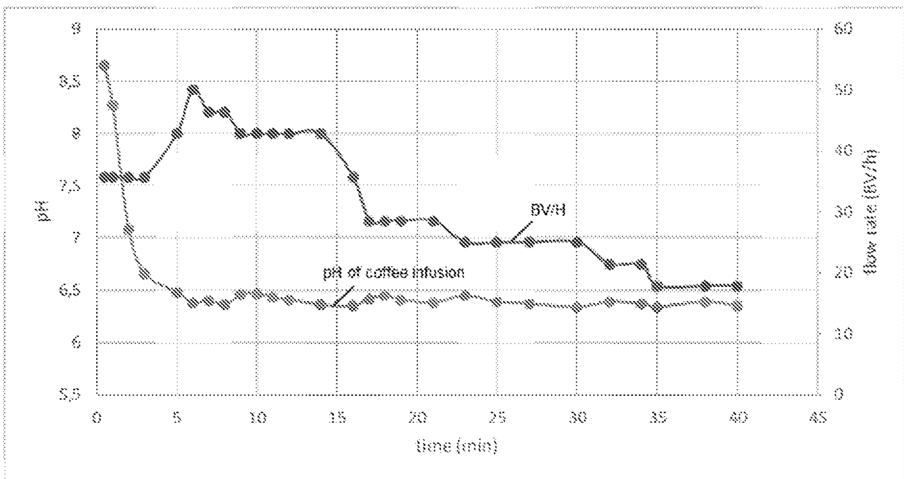

Figure 1

(57) **Abstract:** The disclosure relates to a process for correcting the acidity and/or bitterness of a coffee infusion, a deacidified coffee infusion, a deacidified coffee powder and a pod or capsule comprising a deacidified coffee powder obtained therefrom

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PROCESS FOR TREATING COFFEE AND CORRECTED COFFEE THEREOF

CROSS-REFERENCE TO RELATED APPLICATION

The present application is claiming priority from U.S. Provisional Application No. 63/252,644 filed October 6, 2022, the content of which are hereby incorporated by reference in their entirety.

TECHNICAL FIELD OF THE DISCLOSURE

The disclosure relates to a process for correcting the acidity and/or bitterness of a coffee infusion, a deacidified coffee infusion, a deacidified coffee powder and a pod or capsule comprising a deacidified coffee powder obtained therefrom.

BACKGROUND

The Robusta coffee takes its name from the robustness and the solidity of its tree. Due to its very rapid growth, this species of coffee is easier to grow than Arabica. The main producers of Robusta coffee are Indonesia, Uganda, Ivory Coast, India and Vietnam.

Robusta produces grains that contain twice as much caffeine as those of Arabica, however it stands out for its less elaborate aromas and a more acid and bitter taste.

Traditionally, producers of coffee found in the commerce would reduce acidity by chemical means, such as by neutralizing acidity using buffers, however this may cause anticipated aging of the stored coffee, while imposing additional labeling requirements under certain legislations. In addition, buffering has the tendency to negatively affect the subtle aromatic profiles in the coffee, which in any event can further be masked by more acidic coffee infusions (e.g. at a pH of about 5 or less).

There is a need to improve the acidity/bitterness profile while maintaining as much as possible the aromatic characteristics of the coffee.

SUMMARY

It is provided a process for deacidifying coffee comprising the steps of providing a coffee infusion from ground coffee, and eluting the coffee infusion on a weak anion exchange resin to provide a deacidified coffee infusion after elution.

In an embodiment, the volume (BV) of coffee infusion provided is from about 100 to about 200 BV for coffee infusion having a Brix of about 2 to about 5, or the BV is from about 2 to about 50 BV for coffee infusion having a Brix of about 10 to about 20.

In an embodiment, the coffee infusion provided has a concentration index comprised between 2 and 10 degrees Brix.

In a further embodiment, the coffee infusion provided is concentrated.

In another embodiment, the concentrated coffee infusion has a concentration index from about 10 to about 20 Brix.

In an embodiment, the process described herein further comprises a step of pretreating the coffee infusion.

In a further embodiment, coffee infusion is eluted on the weak anion exchange resin at a circulation flow rate between 5 BV/hour and 250 BV/hour.

In an embodiment, the weak anion exchange resin is made of acrylic, styrene or phenol-formaldehyde polycondensate.

In another embodiment, the weak anion exchange resin is made of acrylic.

In a further embodiment, the weak anion exchange resin comprises a tertiary amine functional group on the resin.

In an embodiment, the weak anion exchange resin has a particle size between 300 and 600 µM.

In a particular embodiment, the weak anion exchange resin is made of beads or non-spherical granules.

In a further embodiment, the weak anion exchange resin is the LEWATIT S5221 resin, Purolite PPA847 resin, Dowex FPA53resin, Diaion WA10 resin, Lanxess MDSS4368 resin, DOWEX 66 resin or Duolite A568 resin.

In an embodiment, the coffee infusion provided has a pH value of about 5 to about 6.

In a further embodiment, the deacidified coffee infusion has a pH value of about 6 to about 7.5.

In an embodiment, the process encompassed herein further comprises the step of removing water from the deacidified coffee infusion forming a deacidified coffee powder.

In an embodiment, the water is removed by freeze-drying or spray drying.

It is also provided a deacidified coffee infusion obtained by the process as encompassed herein.

It is further provided a capsule comprising a deacidified coffee powder as encompassed herein.

In an embodiment, the capsule comprises about 5-7 g of deacidified coffee powder.

BRIEF DESCRIPTION OF THE FIGURES:

Figure 1 shows the pH variation and BV/h of the coffee infusion as a function of time, processed on the resin in accordance with an embodiment;

Figure 2 is a comparative example showing the pH variation of the coffee infusion and capacity of the resin as a function of the BV; and

Figure 3 shows the pH variation and BV/h of the coffee infusion as a function of time, processed on the resin in accordance with an embodiment.

DETAILED DESCRIPTION

"BV" is the acronym for "bed volume", i.e., the volume of resin in the column. Indeed, in the technical field of coffee infusion, implemented in columns filled with ion exchange resin, it is perfectly normal to express the circulation (or in other words, passage) flow rate of the coffee infusion in the column in BV/hour. This has the advantage of indicating the flow rate in a normalized manner, i.e., irrespective of the volume of the column. This is why, in the following description, the circulation flow rate of the coffee infusion will in particular be expressed in BV/hour.

Thus, during the deacidification method as provided herein, the circulation flow rate of the coffee infusion in the column containing an anion exchange resin can vary while remaining comprised between 5 BV/hour and 250 BV/hour or 10 BV/hour and 200 BV/hour.

In one embodiment of the method, the volume (BV) of coffee infusion used in the process will vary according to the initial pH, the required pH output and concentration of the coffee to be deacidified. For example, the BV may be from about 100 to about 200 BV for coffee infusions having a Brix of about 2 to about 5, or the BV may be from about 2 to about 50 BV for coffee infusions having a Brix of about 10 to about 20.

The coffee infusion to be deacidified useful herein may be concentrated or not, for example having a concentration index that may be comprised between 2 and 10 degrees Brix, for a non concentrated infusion, preferably from about 2 to about 5, and for concentrated preferably from about 10 to about 20 Brix.

In one embodiment, the process further comprises a step for pretreatment of the coffee infusion to be deacidified.

This pretreatment step has the advantage of preventing clogging of the column.

During the method provided herein, an anion exchange resin is used in order to deacidify the coffee infusion. Without being bound to theory, it is believed that the resin may capture some organic acids, resulting in an increase in pH which may in turn release "basic" compounds, such as pyridine and pyrazines, which may otherwise be in the form of an acid salt at lower pH. The ionic strength of the medium may also make it possible to observe an increase in the molecules responsible for the taste of coffee.

Preferably, the resin is a weak anion exchange resin. For example, the weak anion exchange resins are comprising ternary amines functional groups that are neutral at a pH greater than 10 and ionized at a pH lower than 10. Consequently, it is understood that a weak anion exchange resin refers to a resin whose cation function is dissociated based on the pH of the solution.

Weak anion exchange resins have the advantage of being very specific to weak acids and multivalent acids. Yet as explained above, the coffee infusion to be deacidified comprises organic acids, which are weak acids.

In the context of the present invention, “weak acid” refers to an acid that is not completely dissociated in water. An acid is weaker when its pKa is higher.

Preferably, the anion exchange resin is an exchange resin of the acrylic, styrene or phenol-formaldehyde polycondensate type. Advantageously, it is an anion exchange resin of the acrylic type. The resin preferably has tertiary amine functional group on the resin The acrylic-type anion exchange resin preferably has a capacity ranging from 1.1 to 3.2.

The particle size of the resin varies between 300 and 600 µM. For example, anion exchange resin may be beads (with uniformity lower than or equal to about 1.7 or preferably about 1.2) or non-spherical granules.

One example of a weak anion exchange resin of the acrylic type is the LEWATIT S5221 resin from LANXESS. Further examples of related acrylic type resins also include Purolite PPA847, Dowex FPA53 and Diaion WA10.

Further examples of resin having a different polymers support may also be used as they have a similar pKa, including Lanxess MDSS4368 (acrylic), DOWEX 66 (polystyrene), Duolite A568 (formaldehyde-phenolic).

In one embodiment of the disclosure, the coffee infusion (to be deacidified) has a Brix degree of from about 2 to about 20 Brix or preferably about 3 to about 15 Brix.

In one embodiment of the disclosure, the pH value of the coffee infusion (to be deacidified) is ranging from about 5 to about 6, preferably from about 5.3 to about 5.7.

In one embodiment of the disclosure, the pH value of the deacidified coffee infusion is ranging from about 6 to about 7.5, preferably about 6.5 to about 7.0, more preferably about 6.5 to about 6.7.

In one embodiment of the disclosure, the pH value of the coffee infusion is increased under the process by 0.5 to 2 pH units, preferably 1 to 2 units. more preferably 1-1.2 to 1.5 units.

The deacidified coffee infusion, or a coffee reconstitued from a deacidified coffee powder as disclosed herein and water may preferably have a pH of from about 6.5 to about 6.7.

The deacidified coffee infusion may further be processed for water removal by conventional methods, for example either by freeze-drying or spray drying methods known to the skilled person in the art, to provide a deacidified coffee powder (or also referred to as soluble coffee, or coffee crystals), for use to reconstitute a drinkable coffee.

The deacidified coffee infusion, coffee powder or pod or capsule as disclosed herein does not comprise additional/external acidity/pH regulator or masking compounds, such as *sodium polyphosphate, dipotassium phosphate*, a base, a chelating agent, or a buffer.

The coffee capsule can be of any shape and size, however is most often of cylindrical shape and is for a single-serve. It is also generally vacuum packed in the capsule made of plastic or aluminum and is suitable for use in infusion coffee machine compatible with the capsule to infuse the coffee powder. A coffee pod is generally a round pod filled with an amount of coffee placed into a filter (e.g. pressed within two filter sheets, such as a material similar to the tea bags). Coffee pods may contain about 7g of coffee and coffee capsule may contain about 5-7 g of coffee.

EXAMPLES

Coffee

The infusions was prepared from a private label Robusta ground coffee under the tradename ECO, distributed by E. Leclerc.

Infusion Preparation:

Five liters of demineralized water were heated at 90 ° C. 500 g of ground coffee were added and the mixture was gently stirred for 2 hours. The suspension is pre-filtered on a fabric cone and the waste coffee grounds were manually pressed to extract additional infusion. After filtration on a 30 µm Büchner system, the infusion had a Brix of about 3.6 ° B.

The infusions were repeated three times using the same batch of commercial ground coffee.

infusion #1

-		pH	brix	weight kg
IN	ground coffee			0.497
	water			5.000
OUT	initial infusion	5.41	3.6	4.023
	waste ground coffee			1.050

infusion #2

-		pH	brix	weight kg
IN	ground coffee			0.505
	water			5.000
OUT	initial infusion	5.49	3.4	4.850

	waste ground coffee			1.109

infusion #3

-		pH	brix	weight kg
IN	ground coffee			0.504
	water			5.000
OUT	initial infusion	5.5	3.7	4.217
	waste ground coffee			1.022

The pH of the coffee resulting (initial) infusion is about 5.5. Infusion # 1 was filtered on a 30 µm filter and used unconcentrated to perform a high volumetric flow rate deacidification process.

Infusions # 2 and # 3 were not filtered at 30 µm but concentrated in a vacuum rotavapor at approximately 14 ° B and then centrifuged to remove suspended solids.

The following Table 1 summarizes the physico-chemical properties of the obtained infusions:

Table 1:

		pH	brix	weight kg
IN	initial infusion	5.5	3.7	4.187
OUT	concentrated infusion	5.5	About 14	0.975

It is noted that the pH of the concentrated infusion does not vary with respect to the initial infusion despite a concentration factor of about 4.

Example 1: High volumetric flow rate deacidification - unconcentrated

The resin was loaded into a glass column with a section of 3.14 cm². A pH meter was placed in a glass measuring cell at the outlet of the column. A peristaltic pump 6-600 rpm (1-100 ml / min) feeds the system.

The process was performed at room temperature (i.e. about 20 to 25 degrees Celsius) at a flow rate of between 150 and 6 BV / h. The product circulates in a loop of the feed beaker with stirring to the resin bed until adjustment to the target pH. The system then switches to linear passage to promote and accelerate the deacidification. Once the entire product has been rinsed the resin with 2 BV demineralized water.

The infusion load of coffee (in liters of infusion / l of resin or BV) was calculated as follows, for example in a case of a target pH of 7.5:

$$C_{H+} = \frac{V_{pH\,7.5} * C_{NaOH}}{E}$$

$$Charge = \frac{CE_{50}}{C_{H+}}$$

wherein:

C_{H+} = free acid concentration of the coffee infusion expressed in eq / l

$V_{pH\,7.5}$ = volume of titrant solution of NaOH poured to reach the pH expressed in ml

CNaOH = concentration of the titrant solution of NaOH expressed in eq / l

E = coffee brewing test sample expressed in ml

CE_{50} = capacity of the ion exchange resin 1.4 eq / l

In the examples below, measurement of free acidity was done by titration with sodium hydroxide 1 eq / l (1 mol / l).

Operating conditions

Resin	*LEWATIT S5221 OH (LANXESS)*
Resin volume	16 ml
Resin bed height	5,1 cm
Free acidity of infusion n°1 (pH 7)	0,009 eq/l (8,7 meq/l)
Loading	160 BV
	i.e. 2000 ml at 3.6°B

The process, carried out on the infusion of unconcentrated coffee, was operated to recover deacidified coffee at pH 5.9, 6.4, and 7.2. The following table summarizes some relevant physico-chemical properties.

Table 2: Physico-chemical properties

Sample ID	brix	%Dry Matter $_{IR}$	Actual pH
	°B	%	-
infusion n°1 (initial)	3.6	2.75	5.41
infusion pH 5.9	3.4	2.57	5.90
infusion pH 6.4	3.5	2.68	6.38
infusion pH 7.2	3.3	2.55	7.24

It can be noted in Table 2 that when the pH increases the brix and the dry matter of the infusion slightly decreases.

Determination of organic acids were done by HPLC ;

- Column : BIORAD HPX87H 7.8*300 mm ;
- Mobile phase: H_2SO_4 8 mM at 0,6 ml/min, 50°C.

Table 3: HPLC Analysis (based on % of surface area)*

Sample ID		RT 7.9	RT 10.0	RT 15.0
	salts	citric acid	malic acid	acetic acid
infusion n°1 (initial)	42.20	6.41	23.21	1.39
infusion pH 5.9	42.81	6.13	22.50	1.40
infusion pH 6.4	43.13	6.18	22.51	1.44
infusion pH 7.2	41.29	5.61	22.56	1.57

* It is believed that the RT in the table correspond to the identified organic acids as they showed the same retention time.

Example 2: High volumetric flow rate deacidification - concentrated

The same process as described above for unconcentrated infusion was used, however a concentrated infusion at about 14 °B, was used (i.e. a concentration factor approximately four times higher than the previous assay). The size of the system was therefore adapted accordingly.

The process produced deacidified coffee at pH at 6.7 (i.e. +1.2 unit), pH 7.0 (i.e. +1.5 unit), pH 7.5 (i.e. +2.0 units).

Table 4: Operating conditions

Resin	LEWATIT S5221 OH (LANXESS)	
Resin volume	8 ml	
Resin bed height	2.55 cm	
Free acidity of infusion (pH 7.5)	0,042 eq/l (42 meq/l)	
Loading	33 to 8,25 BV	
	i.e. 260 ml to 13.9°B	

As shown in Figure 1, the process allowed to reach an average pH of 6.7.

It is believed that a competitive effect on the column was caused by the higher concentration of matters in the infusion and this may reduce the exchange capacity of the resin. Accordingly to produce a higher pH coffee, the amount of resin was increased, causing a corresponding loading reduction to about 8.25 BV, and provided the desired pH of 7.5.

Comparative Example: Slow elution on concentrated infusion (Comparative process)

In this assay, a concentrated infusion was used. This time the product is injected on a lower section column at a lower flow rate (i.e. about 2 BV/h).

The resin was loaded into a 0.79 cm² glass column. Two adjustable pistons at each end (equipped with a PTFE sinter of 30 µm porosity) of the column allow to adjust the level of settlement of the resin. The system was powered by a peristaltic pump 6-600 rpm. the pH was measured directly at the column outlet in a test tube.

This test is considered the reference of ion exchange process: low speed inducing a strong pH variation during production.

Table 5: Operating conditions

Resin	LEWATIT S5221 OH (LANXESS)
Resin volume	14 ml
Resin bed height	17.8 cm
Free acidity of infusion (pH 7.5)	0,043 eq/l (43 meq/l)
Loading	33 BV
	i.e. 450 ml to 14.3°B

Figure 2 shows that under these operating conditions the eluate reached an average pH of 7.5. A strong pH variation was observed (i.e. pH 9.7 at the beginning of production and 6.2 at the end). The maximum load is 30.4 BV or 92.1% of the loading based on free acidity measurement and the data of the resin manufacturer. The output pH at the end of the test is not at the level of that of the feed solution indicating that the resin still has the exchange capacity.

Example 3: High volumetric flow rate deacidification – Progressive loading

The process was conducted using a set-up as described above, except that in this process the loading of concentrated infusion was gradually increased.

The process was started with a loading of 3.6 BV (11% of the useful capacity of the resin) followed by gradually adding, in steps of 50 ml, concentrated infusion while decreasing the flow rate. The output pH and average pH curves met at one point in time. After 50 minutes of loop operation the system was switched to a conventional co flow to complete the deacidification operation.

Table 6: Operating conditions

Resin	LEWATIT S5221 OH (LANXESS)
Resin volume	14 ml
Resin bed height	4.5 cm
Free acidity of infusion	0,042 eq/l (42 meq/l)
Initial Loading	3.6 BV (50 ml to 13.9)
Total Loading	14.3 BV (200 ml to 14.3°B)

As shown in Figure 3, the deacidified concentrated infusion stabilized at the target pH of 7.48. Thus, any strong pH variations was limited while optimizing the exchange capacity of the resin. The total amount of infusion added was 200 ml or 43% of the capacity of the resin.

Example 4: Coffee infusion tasting

Deacidified coffee samples were obtained in accordance with the process of Example 2 above (High volumetric flow rate deacidification – concentrated). The concentrated deacidified coffees were then diluted to a substantially constant value of 4 Brix for tasting.

The testers are amateurs of rather "high-end" coffees. The coffees were tasted at room temperature (around 20 ° C), unsweetened. The testers we asked to rate specific aspects of the coffees (i.e. acidity, bitterness, roundness and burnt) on a scale of 1 to 8, wherein 1 is representing the lowest, even mediocre, quality level, and 8, on the contrary targeting the highest perceived quality.

The testers were also asked to generally comment on their appreciation using traditional descriptors of coffee, whether they are negative ("strong, powerful, unbalanced, burnt, bitter, acidic, acrid, soapy, earthy ... etc.), or positive with regard to smell or taste (such as fruity, nutty, "lightly roasted", long in the mouth, round, "green"...etc).

Table 7: High volumetric flow rate deacidification

	Acidity (1-8)	Bitterness (1-8)	Roundness (1-8)	Burnt (1-8)	General comments
Coffee					
pH 5.5 (crude)	7.5	7	3.5	7.5	Burnt, bitter and acrid
pH 6.0**	6.5	6	4.5	6	Rounder, remains rather harsh, still acidic
pH 6.7	5	5.5	6.5	4.5	Round, dry fruit, sweet
pH 7.0	4.5	5	5	4	Flatter, less "attack" than the previous one, nevertheless more qualitative than untreated, in line with the previous one (pH 6.5)

** obtained by mixing crude pH 5.5 coffee and pH 7.5 deacidified coffee obtained by the process herein.

In view of the above observations, it was concluded that there was a fairly clear gradation in perceived quality with the gradual increase in pH, largely demonstrating the advantages provided by the process of the invention.

Although, the pH 7.5 deacdified coffee was not tasted per se, it was used to combine with pH 5.5 crude coffee in order to assess the possible positive effect of introducing such deacidified coffee in a crude acidic coffee. Surprisingly, even such combination was capable of improving the score of the resulting coffee on tasting.

Table 8: Slow elution deacidification

	Acidity (1-8)	Bitterness (1-8)	Roundness (1-8)	Burnt (1-8)	General comments
Coffee					
pH 5.5 (crude)	7.5	7	3.5	7.5	Burnt, bitter and acrid
pH 6.0	6	6.5	4	7	Still acidic, burnt
pH 6.5	5.5	6.5	3.5	7	flat, no distinctive taste, light soap-like taste
pH 7.0	4	5	4	5	Without coffee taste, no favour, no "attack", "chicory taste", "soap-like taste"

The roundness and characteristic coffee notes are disappearing in the coffee deacidified by classic ion exchange.

As discussed above, and in sharp contrast, the coffee deacidified in accordance with the process of the invention enhanced the characteristic coffee notes.

Example 5: Quantitative analysis of selected compounds in infusions

Deacidified coffees as described in Example 4 above were used to perform the following quantitative analysis.

It is now well known that coffee are comprising a number of aromatic compounds that together provide characteristic odours and tastes, certain negatively, other positively. It was decided to assess the content in certain pyridine and pyrazine compounds using analytical methods.

The equipment used was headspace coupled to a GC-MS.

Gas chromatography

Head Space:
Oven : at 100° C;
Sample loop : 150°C;
Transfer line : 200°C;
Total/ injected volumes: 20 mL/10 mL;

Gas chromatography:
HP5-MS column: 30 meters * 250µm * 0.25µm
50 ° C (for 3 min), increased at 5 °C/ min to 150 °C, increased at 10 ° C / min to 250 ° C (for 7 min)
Helium at constant flow rate of 1 ml / min.

Mass spectrometry:

Acquisition in selected ion monitoring (SIM) mode on the ions 79 (pyridine), 94 (Methyl pyrazine), 108 (Dimethyl / ethyl pyrazines), 121 (trimethyl, ethyl / methyl pyrazines) and 135 (tetramethyl pyrazine). The acquisition in SIM mode allowed to gain sensitivity because the molecules are not concentrated.

10 ml of coffee infusion (adjusted to 10 ° B with water) were injected.

The following Table 9 provides a summary of the analysis. The results are expressed in regard to relative intensity (i.e. not weight or volume amounts) obtained by integration of the curves and peak obtained.

Table 9:

	Integration data			
Name FEMA# CAS#	Crude infusion pH 5.5	pH 6	pH 6.7	pH 7
Pyridine 2966 110-86-1	512.1	812.44	55387	46011
2-methyl pyrazine 3309 109-08-0	770.5	953.83	4956	5643
2,3-dimethyl pyrazine 3271 5910-89-4	949.1	633.07	3173	3583
2,5-dimethyl pyrazine 3272 123-32-0	229.5	479.18	2232	2343
2,6-dimethyl pyrazine 3273 108-50-9	0	0	1104	1445
2-ethyl-3-methyl pyrazine 3155 15707-23-0	292.8	200.29	2013	2117
2-ethyl-5-methyl pyrazine 3154 13360-64-0	0	0	1548	1804
2-ethyl-6-methyl pyrazine 3919 13925-03-6	0	0	1761	1613
2-ethyl-3,(5- or 6-) dimethyl pyrazine* 3149 27043-05-6	241.7	133.56	2358	2191

* Mixture of 5 and 6 isomer

Table 10:

	% area vs crude			
Name FEMA# CAS#	Crude infusion pH 5.5	pH 6	pH 6.7	pH 7
Pyridine 2966 110-86-1	100	158.6	10815.7	5663.3
2-methyl pyrazine 3309 109-08-0	100	123.8	643.2	591.6
2,3-dimethyl pyrazine 3271 5910-89-4	100	66.7	334.3	566.0
2,5-dimethyl pyrazine 3272 123-32-0	100	208.8	972.5	489.0
2,6-dimethyl pyrazine 3273 108-50-9	0	0	Infinite	Infinite
2-ethyl-3-methyl pyrazine 3155 15707-23-0	100	68.4	687.5	1057.0
2-ethyl-5-methyl pyrazine 3154 13360-64-0	0	0	Infinite	Infinite
2-ethyl-6-methyl pyrazine 3919 13925-03-6	0	0	Infinite	Infinite
2-ethyl-3,(5- or 6-) dimethyl pyrazine* 3149 27043-05-6	100	55.3	975.6	1640.5

* Mixture of 5 and 6 isomer

Pyridine provides the perceived "burnt" flavour and is detectable at 10g / ton. This may therefore be considered a negative "note". Pyrazines molecules have a detection threshold of 0.01g to 1g / ton. Certain pyrazines such as 2-methyl pyrazine, 2,5-dimethyl pyrazine and 2,6-dimethyl pyrazine provide a green, hazelnut, coconut, oily, slightly toasted feature, much like ethyl dimethyl pyrazine. On the other hand, the ethyl methyl pyrazine compounds offer a rougher character that can go as far as baked, roasted potato related. 2-ethyl-3,(5- or 6-) dimethyl pyrazine, on the other hand provide the fruity and green sensation.

From the above analytical results, it is noted that there is an increase of pyridine content, which may be consistent with bitterness sensation in the tasting discussed above, up to a pH 6.7 and which then declines above that pH.

A strong increase is observed for the desirable pyrazines, and because of their relatively low detection threshold, it can be hypothesize that these “good molecules” take precedence over the less pleasant compounds, which are earthy compounds. Therefore, at pH values between 6.5 / 6.7 and above, one can detect pleasant fruity notes which were undoubtedly masked in “raw” coffees (before deacidification).

It is therefore conceivable that the increase in certain pyrazine compounds, which is partially covering the bitterness of pyridine, coupled to the concomitant decrease in said pyridine (e.g. when raising the pH) is to some extent explaining the observations outlined in the tasting results discussed above.

Without being bound to theory, it is possible that the increase in pH may release “basic” compounds, such as pyridine and pyrazines, which may otherwise be in the form of an acid salt at lower pH. The ionic strength of the medium may also make it possible to observe an increase in the molecules responsible for the taste of coffee. The process disclosed herein therefore changes pH of the infusion to less acidic but also allows for correcting the balance in the aromatic compounds to provide a better overall taste for the coffee.

While the present disclosure has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modifications and this application is intended to cover any variations, uses, or adaptations including such departures from the present disclosure as come within known or customary practice within the art and as may be applied to the essential features hereinbefore set forth, and as follows in the scope of the appended claims.

CLAIMS

1. A process for deacidifying coffee comprising the steps of:

- providing a coffee infusion from ground coffee, and

- eluting the coffee infusion on a weak anion exchange resin to provide a deacidified coffee infusion after elution.

2. The process of claim 1, wherein the volume (BV) of coffee infusion provided is from about 100 to about 200 BV for coffee infusion having a Brix of about 2 to about 5, or the BV is from about 2 to about 50 BV for coffee infusion having a Brix of about 10 to about 20.

3. The process of claim 1 or 2, wherein the coffee infusion provided has a concentration index comprised between 2 and 10 degrees Brix.

4. The process of claim 1 or 2, wherein the coffee infusion provided is concentrated.

5. The process of claim 4, wherein the concentrated coffee infusion has a concentration index from about 10 to about 20 Brix.

6. The process of any one of claims 1-5, further comprising a step of pretreating the coffee infusion.

7. The process of any one of claims 1-6, wherein the coffee infusion is eluted on the weak anion exchange resin at a circulation flow rate between 5 BV/hour and 250 BV/hour.

8. The process of any one of claims 1-7, wherein the weak anion exchange resin is made of acrylic, styrene or phenol-formaldehyde polycondensate.

9. The process of any one of claims 1-8, wherein the weak anion exchange resin is made of acrylic.

10. The process of any one of claims 1-9, wherein the weak anion exchange resin comprises a tertiary amine functional group on the resin.

11. The process of any one of claims 1-10, wherein the weak anion exchange resin has a particle size between 300 and 600 µM.

12. The process of any one of claims 1-11, wherein the weak anion exchange resin is made of beads or non-spherical granules.

13. The process of any one of claims 1-12, wherein the weak anion exchange resin is the LEWATIT S5221 resin, Purolite PPA847 resin, Dowex FPA53resin, Diaion WA10 resin, Lanxess MDSS4368 resin, DOWEX 66 resin or Duolite A568 resin.

14. The process of any one of claims 1-13, wherein the coffee infusion provided ahs a pH value of about 5 to about 6.

15. The process of any one of claims 1-14, wherein the deacidified coffee infusion has a pH value of about 6 to about 7.5.

16. The process of any one of claims 1-15, further comprising the step of removing water from the deacidified coffee infusion forming a deacidified coffee powder.

17. The process of claim 16, wherein the water is removed by freeze-drying or spray drying.

18. A deacidified coffee infusion obtained by the process of any one of claims 1-17.

19. The deacidified coffee infusion of claim 18, wherein the deacidified coffee infusion is a powder.

20. A capsule comprising a deacidified coffee powder as defined in claim 19.

21. The capsule of claim 20, comprising about 5-7 g of deacidified coffee powder.

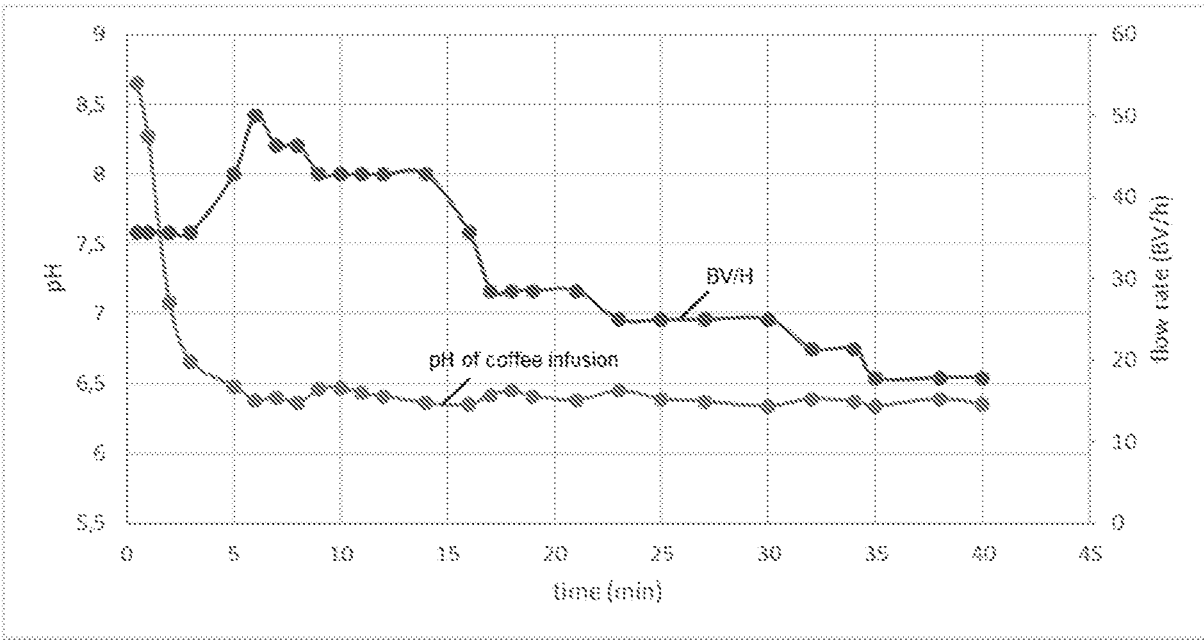
9
8,5
8
7,5
7
6,5
6
5,5
pH
60
50
40
30
20
10
0
flow rate (BV/h)
0
5
10
15
20
25
30
35
40
45
time (min)
BV/H
pH of coffee infusion

Figure 1

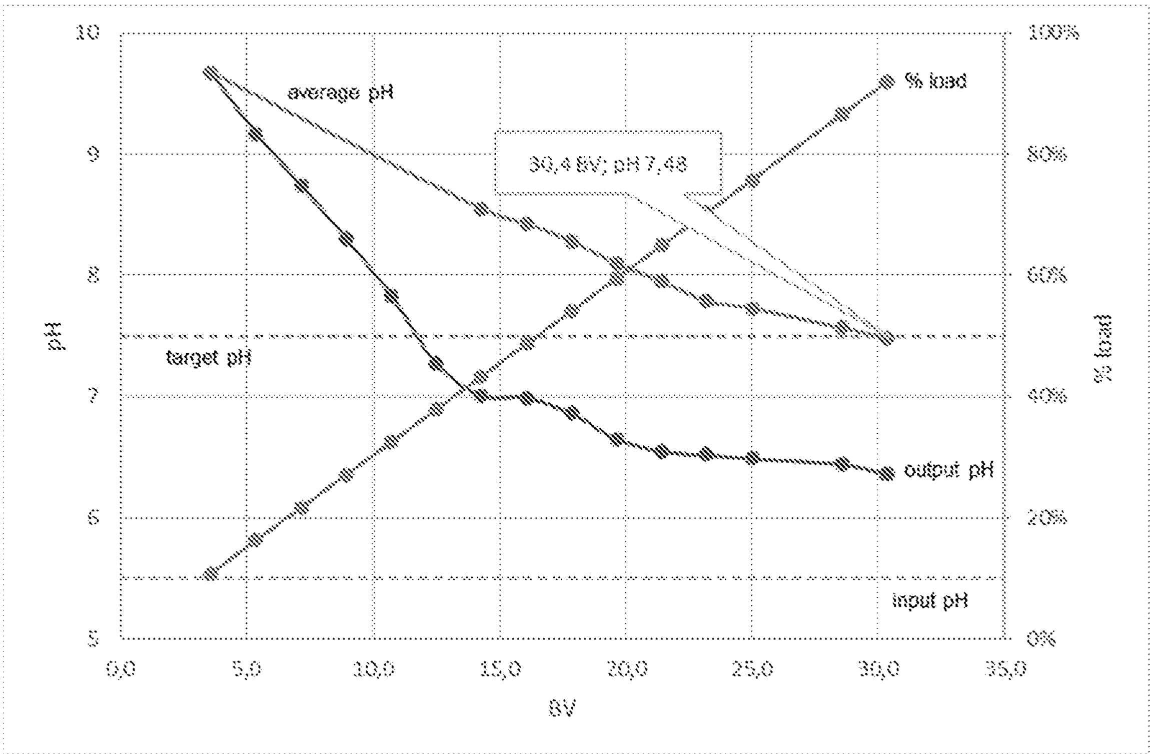
10
9
8
7
6
5
pH
100%
80%
60%
40%
20%
0%
% load
average pH
% load
30,4 BV; pH 7,48
target pH
output pH
input pH
0,0
5,0
10,0
15,0
20,0
25,0
30,0
35,0
BV

Figure 2

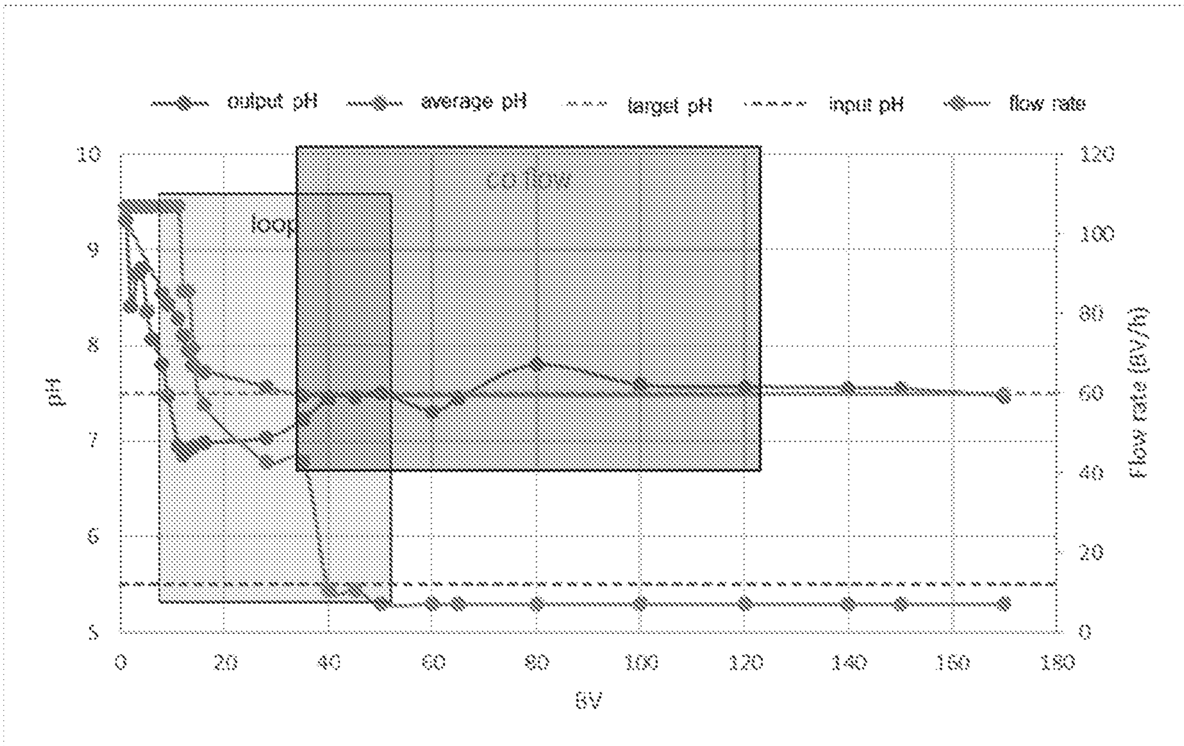
output pH
average pH
target pH
input pH
flow rate
loop
co flow
pH
Flow rate (BV/h)
BV
10
9
8
7
6
5
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
180

Figure 3