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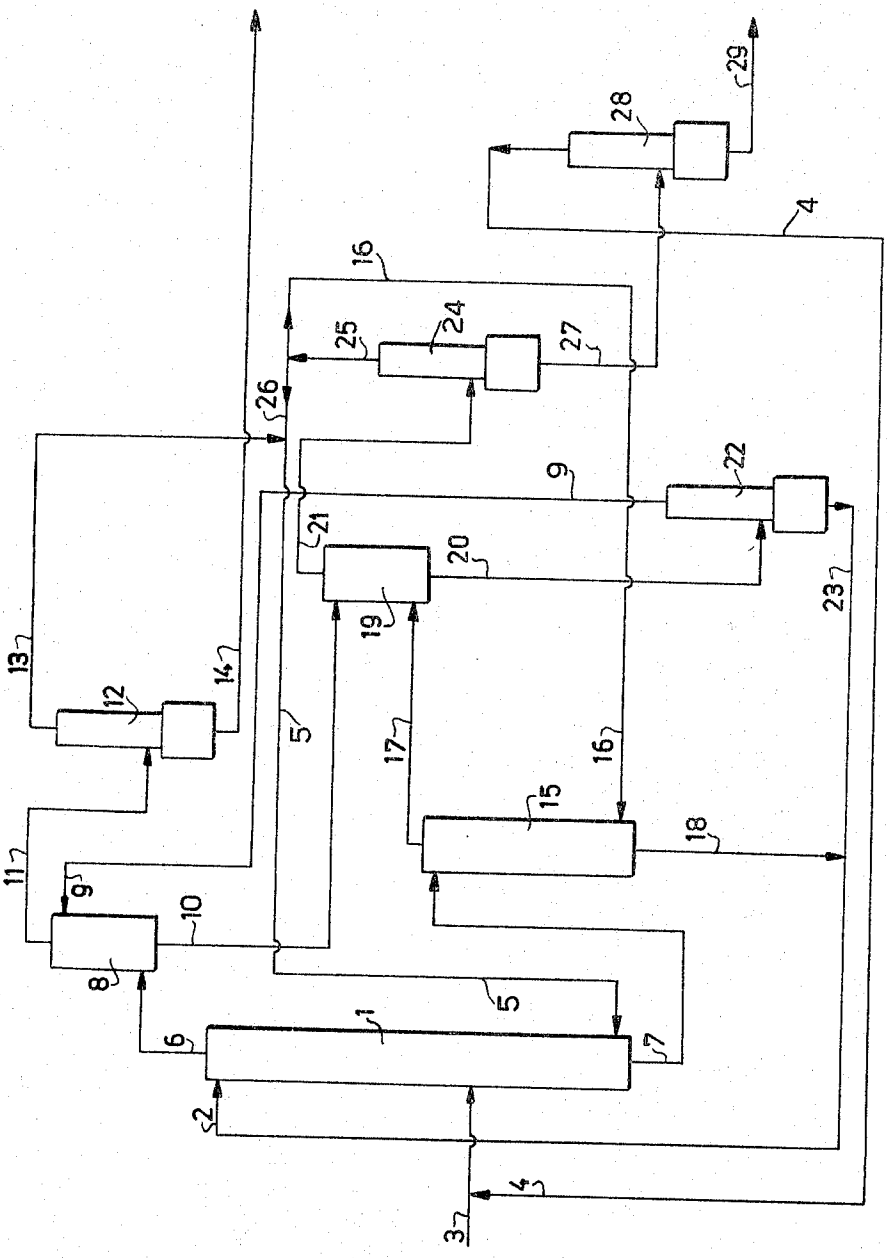

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PROCESS FOR EXTRACTING AROMATIC HYDROCARBONS FROM HYDROCARBON MIXTURES CONTAINING SAME

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10 Claims. (Cl. 208—321)

This invention relates to a process for the separation of aromatic hydrocarbons from hydrocarbonaceous mixtures by solvent extraction, which is efficient both in the treatment of low-boiling and of high-boiling hydrocarbonaceous fractions.

The prior art disclosed many processes for the extraction with solvent of aromatic hydrocarbons from hydrocarbonaceous fractions. According to these processes, the extract consisting of the solvent and the aromatic hydrocarbon contained therein is distilled so as to regenerate the solvent while recovering the aromatic compound.

These processes prove to be efficient only so long as the boiling point of the solvent is notably different from the boiling point of the hydrocarbon contained in the extract, but cannot be readily applied when the boiling points of the solvent and of the hydrocarbon, respectively, are near to one another.

An object of the present invention is to provide a process for the extraction of aromatic hydrocarbons which can be readily applied even when the boiling points of the hydrocarbons and of the solvent present in the extract are near to one another.

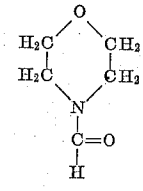
Inasmuch as in the extract the maximum concentration which can be obtained, in terms of aromatic hydrocarbons, from the hydrocarbonaceous fraction contained in the extract is given, in the triangular plot solvent-aromatics-nonaromatics, by the tangent to the binodal curve passing through the solvent apex, and inasmuch as said concentration is not sufficient, in general, to give a sufficiently pure aromatic product, it is necessary to adopt various modes of operation in order that the purity of the extracted aromatic fraction be increased. It is possible, for example, to modify the characteristics of the solvent by adding thereto substances which, like water, modify the triangular plot aforesaid so as to make the solvent more selective; it is also possible so to modify the triangular plot so as to convert it into an open plot, i.e. of a kind in which a reflux of aromatics contributes towards an improvement of the purity of the final extract. Refluxes from the side of the extract of a low-boiling non-aromatic component are also known, said component being more soluble, in the solvent, than the non-aromatics having a higher boiling point. Said refluxes remove from the extract the non-aromatic hydrocarbons having the higher boiling points and replace the latter, whereafter they can be easily separated from the aromatics extracted by distillation, owing to the notable difference between the respective boiling points. The necessity of said operations for extracting adequately pure aromatics imposes therefore expensive processing runs.

Distillation of the extract, the presence of water, even in large amounts, in the solvent and which is distilled off from the extract and is to be recycled, along with the large amounts of hydrocarbonaceous refluxes, make the heat waste, for the production of aromatic hydrocarbons, considerable.

An object of the present invention is to provide a process which permits producing high-purity aromatics from hydrocarbonaceous mixtures containing them, with a limited expenditure of thermal energy.

U.S. Patent No. 2,357,667 discloses aldo- and ketomorpholines as having a selective solving power for those components of hydrocarbonaceous mixtures which show the higher carbon to hydrogen ratios and, more particularly, for the aromatics.

Formylmorpholine, more particularly 4-formylmorpholine, having the formula:



exhibits, either alone or admixed with water, solvent properties for the aromatics, which are fully satisfactory as far as transferring power and selectivity are concerned.

An inherent drawback shown by these solvents and, more particularly, by formylmorpholine, is its corrosive power, along with the extremely low stability at temperatures over 90° C., especially if water is present.

Still more particularly, formylmorpholine, both in its anhydrous and hydrated form, exhibits a corrosive action towards the conventional materials and is rapidly altered in the presence of ferrous products of the corrosion.

An object of the present invention is to provide a process which uses the satisfactory solvent characteristics of formylmorpholine in spite of the aforementioned shortcomings. It is thus compulsory that formylmorpholine be employed, in each and every stage of the process run, at temperatures under 90° C. The foregoing objects are achieved by a process which comprises the following steps:

Feeding at one end of a counterflow contact system a solvent which essentially consists of formylmorpholine, feeding the stock at one or more intermediate points of said system, feeding a non-aromatic reflux, having a boiling point lower than that of said stock, at the end of the system which is opposite to the solvent feed-in point, distilling off from the refined stock the lightweight fraction coming from the non-aromatic reflux, washing the extract in counterflow with a non-aromatic hydrocarbonaceous fraction having a boiling point lower than that of the aromatics contained in the extract and discharging, from one side a stream consisting of virtually aromatic-free regenerated solvent and, from the other side, a stream formed by the hydrocarbons retained by the extract and by the non-aromatic hydrocarbonaceous washings.

Said stream is sent to the distillation system to remove the fraction employed for the washing step from the extracted hydrocarbons.

In the processing steps outlined in the foregoing, that is to say, in the steps in which formylmorpholine is present, the temperature is maintained between 20° C. and 90° C., the 25° C.–70° C. range being preferred, i.e. in the stability and non-corrosiveness field of formylmorpholine.

The treatment of the extracted fraction consists of a distillation of the non-aromatic lightweight fraction which is utilized as the washing and refluxing agent, and of a subsequent distillation, from the tailings of the previous distillation step, of a fraction which is recycled to the extraction as stock and is formed by a fraction of the more volatile hydrocarbon along with the small amount of possibly present non-aromatics. The final product essentially consists of aromatic hydrocarbons.

The transferring power and the selectivity of phenylmorpholine are so favorable the solvent/stock ratio, as well as the amounts and refluxed and recycled fluids are drastically reduced with respect to the prior art methods.

The ratio by volume of the solvent to the fed-in stock ranges between 1 to 1 and 5 to 1, and preferably lies between 2:1 and 3.5:1. Even with so low values as compared with those of the known methods, it is possible to recover aromatics with yields over 96% and with a "nitration grade" purity.

The addition of water to formylmorpholine does not display any appreciable effects but improves the selectivity thereof while causing the solvent power to be decreased, as occurs also with the prior art solvents. In practice the process employing hydrated formylmorpholine exhibits the following differences over the process with anhydrous formylmorpholine:

The solvent to stock ratio is slightly higher, still within the aforementioned range.

The reflux to stock ratio is slightly lower.

A lesser amount of washing fraction is experienced.

More particularly it is fitting to note that, even though the process employs aqueous formylmorpholine, the heat balance of the process is kept unaltered since the water contained in the solvent does not enter distillation steps, as contrasted to the prior art methods. Differently from the known methods, refluxing aromatic hydrocarbons at the extract discharge end would prove not only unprofitable, but even harmful. As a matter of fact, as formylmorpholine has a selectivity which is high enough as to make it unnecessary to resort to water additions in so high amounts as to convert the closed triangular plot "solvent-non-aromatic-aromatic" into an open plot, the aromatic reflux would induce in the extract a solubilization of the two phases at the equilibrium at the extract end.

The water reflux, adopted in few processes, is affected, in general, by the shortcoming that one is compelled to distill off from the solvent of the extract the amount of water which appertains to the reflux and thus, on account of the high latent heat of evaporation of water (about 540 calories per kg.), an increase of heat waste would become compulsory.

The very high selectivity towards aromatics along with the very low solvent power for non-aromatics as shown by formylmorpholine, which on the other hand displays a preferential solubility for the lightweight non-aromatics with respect to the heavier ones, acts in such a way that a reflux of low-boiling non-aromatics, preferably paraffins, is more advisable. It has been found that the volume ratios of non-aromatic refluxes to fresh stock as fed are fit to the purpose according to an unexpectedly low rating, i.e. between 0.15 to 1 and 0.7 to 1; and preferably between 0.25 to 1 and 0.5 to 1.

The more volatile fraction which is distilled off from the solvent-deprived extract, after the separation of the non-aromatic to be used for washing and refluxing, contains a notable aliquot of the more volatile aromatic hydrocarbon along with virtually all the non-aromatic components which were present. Said fraction is not used for refluxing, in that the aromatics which are present would not give rise to an advantage for said operation, but is fed-in at the extraction stage as a stock, i.e. in the stage in which the hydrocarbonaceous fraction which is present has a composition which is near that of the stream to be fed-in, not to trouble the extraction conditions or to cause

the undesirable solubilization of the phases at the equilibrium, either.

The usefulness of the separation, from the extract, of a fraction comprising a portion of the more volatile aromatic component along with all the non-aromatics, which generally have a low boiling point, is inherent in the improvement of the final extract and not in the extraction conditions. Said recycled fraction, however, is but a slight fraction of the stock and the effective ratio of said fraction of the fresh stock lies between 0.02 to 1 and 0.2 to 1.

The extract-washing step for recovering, on the one side, the solvent and, on the other side the aromatic hydrocarbons, has proven to have a surprising efficiency; the ratio of the nonaromatic lightweight fraction employed for the washing, to the amount of the solvent introduced at the extraction stage lies between 0.5 to 1 and 1.2 to 1 in order that a virtually total recovery of the aromatic hydrocarbons be obtained. By way of example only, a washing carried out in a system comprised of 6 to 10 stages permits the obtention of a solvent having an aromatics content of less than 1% by weight and a content of non-aromatic lightweight washings of less than 2% by weight.

One of the advantages of the present invention lies in that the extraction of the aromatic fraction and the separate recovery of the solvent and of the hydrocarbon of the extract are carried out without heat waste and with simple implementation. Very satisfactory results are obtained with a few stages of conventional counterflow contact columns.

With the inventive process, formylmorpholine has proven to be extremely stable and noncorrosive and, under these respects, it has proven equal to the conventional solvent fluids.

By way of example, a typical embodiment of the process, as applied to the fractions from C_6 to C_8, will be described with the aid of the accompanying drawing.

An extraction system **1** is charged with the solvent, consisting of anhydrous formylmorpholine, via the conduit **2**, with the fresh stock, consisting of a 60° C.–150° C. aromatic-containing fraction, via the conduit **3**, with a recycling feed formed by a C_6 fraction through the conduit **4**, with a non-aromatic reflux having a boiling point lower than 60° C. and essentially consisting of a C_5 fraction through the conduit **5**. From the top, the refined stock is discharged through the conduit **6** and, from the lower end the extract is discharged via the conduit **7**.

The refined stock is then introduced in the washing system **8** wherein, through the conduit **9**, water is fed in. Within said washing system **8**, the traces of formylmorpholine contained in the refined stock are removed in the form of a very diluted aqueous solution which is discharged via the conduit **10**, whereas the solvent-freed refined stock is forwarded to the conduit **11**.

The solvent-free refined stock is sent to the column **12** wherein a fraction, boiling under 60° C., is distilled off the refined stock, i.e. the fraction appertaining to the low-boiling nonaromatic reflux. Said fraction is removed via the conduit **13**, whereas the bottoms form the final refined stock which is sent out via the conduit **14**.

The extract, discharged with the conduit **7**, is introduced in the washing system **15** wherein, via the conduit **16**, a lightweight non-aromatic fraction whose boiling point is under 60° C., is also introduced. The two fed-in streams are counterflown with respect to one another with an exchange of materials and two streams are discharged, the lightest one forming the solvent-free extract containing the extracted hydrocarbons and the hydrocarbonaceous washing fraction which is discharged via the conduit **17**, the heavier one consisting of formylmorpholine with a small amount of hydrocarbons which is discharged via the conduit **18**.

The solvent-free extract is then introduced, via the duct **17**, into the washing system **19** wherein the formylmor-

pholine traces which are possibly present are washed with water having a low content of formylmorpholine which is coming through the conduit **10**.

The washing system **19** thus discharges two streams, the heavier one consisting of water with formylmorpholine which is discharged via the conduit **20**, the lighter one, formed by the solvent-free extract, which is discharged through the conduit **21**.

Water and formylmorpholine, discharged through the conduit **20**, are introduced in to the column **22**.

Said fraction, which is a small amount, is distilled under proper conditions to recover formylmorpholine, discharged via the conduit **23**, and combined in the conduit **2** with the stream coming from **18**, and water which, via the conduit **9**, is utilized for the washing step again.

The solvent-free extract, from the conduit **21**, is introduced in the column **24** wherein a fraction-boiling under 60° C. is distilled off as a head portion which is then discharged via the conduit **25**. Said fraction is parted into two streams, either of which is combined via the conduit **26** with the stream coming from the conduit **13** and then through the conduit **5** and is used as a refluxing agent, the other one being sent through the conduit **16** to the system **15** as a washing agent.

The "bottoms" of column **24**, consisting of aromatic hydrocarbons extracted from the stock and a small portion of non-aromatic, virtually low-boiling hydrocarbons, for which the reflux and the washing fraction are responsible, is fed into the column **28** via the duct **27**.

In said column **28** is distilled a head fraction which, via the conduit **4**, is sent back to the extraction stage as a recycle, and consists of a slight non-aromatic fraction which is present in the extract and in a portion of the more volatile aromatic hydrocarbon. The bottom product essentially contains aromatic hydrocarbons only and is discharged via **29** and sent to an aromatic-fractionation stage (not shown).

Any kind of hydrocarbonaceous stock containing an aromatic fraction can be treated according to the inventive process in order to recover aromatics.

In general petroleum stocks are used for the production of aromatics and more particularly the reforming products which have a notable content of aromatic hydrocarbons.

The inventive process is characterized by its possibility of being employed for the whole set of aromatic hydrocarbons, from benzene to naphthalene, in that the boiling point of the solvent is immaterial to the end of putting the process into actual practice.

While the process is being progressively applied to the heavier fractions, also the non-aromatic fraction employed for refluxing and washing can be displaced towards the heavier members: for example, if the lowest boiling aromatic to be extracted is benzene, the non-aromatic

fraction will be, advantageously, a pentane fraction, whereas, if the lowest-boiling aromatic to be extracted were xylene, the non-aromatic fraction to be used for refluxing and washing could be a heptane fraction.

In order that the advantages of the invention may appear fully conspicuous a few examples will be reported hereinafter, which are not to be construed as limiting the invention in any wise.

EXAMPLE 1

The raw stock employed is a catalytic reforming gasoline having the following specifications:

Specific gravity at 20° C.	0.7570
Refraction index N_D^{20}	1.4290
Benzene ---percent by weight--	4.47
Composition:	
Toluene ---percent by weight--	17.41
Xylenes plus ethylbenzene ---do---	23.24
Paraffins ---do---	54.88
A.S.T.M. distillation:	
Start ---° C--	65
1% distils at ---° C--	72
5% distils at ---° C--	85
10% distils at ---° C--	88
20% distils at ---° C--	90
30% distils at ---° C--	96
40% distils at ---° C--	100
50% distils at ---° C--	106
60% distils at ---° C--	112
70% distils at ---° C--	119
80% distils at ---° C--	126
90% distils at ---° C--	133
95% distils at ---° C--	139
End ---° C--	144
Residue ---percent--	1
Recovery ---do---	99

By employing a process with an anhydrous solvent similar to that described in the diagram of the accompanying drawing, wherein the extraction column consists of 15 stages and the extract washing column comprises 7 stages, and operating at an extraction and washing temperature of 25° C., the results tabulated in Table 1 have been obtained. The volume ratio as employed, of solvent to stock is 2.5 to 1, the employed ratio of light-weight non-aromatic washing fraction to solvent is 0.9 to 1; the ratio of refluxing agent to fresh stock is 0.4 to 1; the ratio of recycle to fresh stock is 0.1 to 1.

The refluxing and washing fraction essentially consists of pentane.

The rates of flow and the compositions shown in Table 1 are by volume and refer, each, to the reference numerals of the flow diagram shown in the accompanying drawing, said numerals being shown at the head of the table.

TABLE 1

	2		3		4		5		6		7		8	
	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent
Pentane	6.225	2.49			1.00	10.00	39.672	99.18	33.450	34.98	13.447	4.42		
Saturated Hyd	0.050	0.02	60.41	60.41	0.20	2.00	0.282	0.71	60.648	63.43	0.294	0.10		
Benzene	2.175	0.87	3.87	3.87	8.30	83.00	0.046	0.11	0.167	0.17	14.224	4.67		
Toluene	0.400	0.16	15.30	15.30	0.50	5.00			0.090	0.09	16.110	5.29		
Xylenes	0.050	0.02	20.42	20.42					0.670	0.70	19.800	6.51		
Solvent	241.100	96.44							0.600	0.63	240.500	79.01		
Water													10.00	100.00
Total	250.000	100.00	100.00	100.00	10.00	100.00	40.000	100.00	95.625	100.00	304.375	100.00	10.00	100.00

TABLE 1—Continued

	10		13		14		16		17		18	
	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent
Pentane			33.450	99.22			222.750	99.00	229.972	80.66	6.225	2.55
Saturated Hyd			0.238	0.70	60.41	98.53	1.575	0.70	1.819	0.64	0.050	0.02
Benzene			0.027	0.08	0.14	0.23	0.675	0.30	12.724	4.46	2.175	0.89
Toluene					0.09	0.15			15.710	5.51	0.400	0.16
Xylenes					0.67	1.09			19.750	6.93	0.050	0.02
Solvent	0.60	5.66							5.130	1.80	235.370	96.36
Water	10.00	94.34										
Total	10.60	100.00	33.715	100.00	61.31	100.00	225.000	100.00	285.105	100.00	244.270	100.00

	20		21		23		25		26		27		29	
	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent
Pentane			229.972	82.14			228.972	99.00	6.222	99.00	1.00	2.05		
Saturated Hyd			1.819	0.65			1.619	0.70	0.044	0.70	0.20	0.41		
Benzene			12.724	4.54			0.694	0.30	0.019	0.30	12.03	24.71	3.73	9.64
Toluene			15.710	5.61							15.71	32.27	15.21	39.31
Xylenes			19.750	7.06							19.75	40.56	19.75	51.05
Solvent	5.73	36.43			5.73	100.00								
Water	10.00	63.57												
Total	15.73	100.00	279.975	100.00	5.73	100.00	231.285	100.00	6.285	100.00	48.69	100.00	38.69	100.00

It can be seen that the recovery of aromatic hydrocarbons is 96.38% for benzene, 99.41% for toluene, 96.71% for the xylenes, the overall recovery is 97.73%.

EXAMPLE 2

The same stock of the preceding example has been treated with an aqueous solvent, still maintaining a temperature of 25° C. in the extraction and washing stages.

The operative conditions and the result obtained are tabulated in Table 2.

The flow diagram of the process is the same as that of the accompanying drawing, with the only exception that the stream **13** is combined with the stream **16** instead of being combined to the stream **26** to form the reflux stream **5**.

The reflux stream **5**, therefore, will have the same composition of the stream **25**.

The recovery of aromatic hydrocarbons is 96.40% for benzene, 97.42% for toluene, 94.86% for xylenes, the overall recovery being as high as 96%.

The substantial result of this processing run lies in the lesser amount of hydrocarbons to be distilled in a cycle, a slightly lower yield of aromatics being obtained.

EXAMPLE 3

The raw stock employed is a cut 63°–103° C. of a catalytic reforming gasoline having the following specifications:

Specific gravity at 20° C.	0.7464
Refraction index n_D^{20}	1.4248
Benzene —percent by volume	19.00
Toluene —do—	18.08
Paraffins —do—	62.92

TABLE 2

	2		3		4		5		6		7		9	
	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent
Pentane	5.400	1.80			1.00	10.00	39.60	99.00	29.340	31.88	16.660	4.95		
Saturated Hyd	0.060	0.02	60.41	60.41	0.20	2.00	0.28	0.70	60.618	65.85	0.332	0.09		
Benzene	0.936	0.31	3.87	3.87	8.30	83.00	0.12	0.30	0.162	0.18	13.064	3.65		
Toluene	0.780	0.26	15.30	15.30	0.50	5.00			0.395	0.43	16.185	4.52		
Xylenes	0.624	0.21	20.42	20.42					1.049	1.14	19.995	5.59		
Solvent	283.434	94.48							0.479	0.52	282.955	79.05		
Water	8.766	2.92									8.766	2.45	10.00	100.00
Total	300.000	100.00	100.00	100.00	10.00	100.00	40.00	100.00	92.043	100.00	357.957	100.00	10.00	100.00

	10		13		14		16		17		18		20	
	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent
Pentane			29.340	99.22			148.084	99.00	188.684	77.83	5.400	1.83		
Saturated Hyd			0.208	0.70	60.410	97.45	1.046	0.70	1.526	0.63	0.060	0.02		
Benzene			0.023	0.08	0.139	0.22	0.450	0.30	12.601	5.20	0.936	0.32		
Toluene					0.395	0.64			15.405	6.35	0.780	0.26		
Xylenes					1.049	1.69			19.371	7.99	0.624	0.21		
Solvent	0.479	4.57							4.849	2.00	278.106	94.39	5.328	34.76
Water	10.000	95.43									8.766	2.97	10.000	65.24
Total	10.479	100.00	29.571	100.00	61.993	100.00	149.580	100.00	242.436	100.00	294.672	100.00	15.328	100.00

TABLE 2—Continued

	21		23		25		13-16		27		29	
	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent	Parts	Percent
Pentane	188.684	79.43			187.684	99.00	177.424	99.04	1.000	2.08		
Saturated Hyd	1.526	0.64			1.326	0.70	1.254	0.70	0.200	0.42		
Benzene	12.601	5.30			0.570	0.30	0.473	0.26	12.031	25.06	3.731	9.82
Toluene	15.405	6.48							15.405	32.09	14.905	39.22
Xylenes	19.371	8.15							19.371	40.35	19.371	50.96
Solvent			5.328	100.00								
Water												
Total	237.587	100.00	5.328	100.00	189.580	100.00	179.151	100.00	48.007	100.00	38.007	100.00

The extraction was carried out at the following operative conditions:

Volume ratio solvent to stock	1.2/1
Temperature ° C	25
Water in solvent mixture — percent by weight	3
Volume ratio of aromatic reflux to stock	0.1/1
Volume ratio of nonaromatic reflux to stock	0.3/1
Volume ratio of washing pentane to solvent	1.34/1

The recovery of aromatic hydrocarbons was 96.4% for benzene and 95.2% for toluene, with a complexive purity of 98.59% by volume.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A process for obtaining aromatic hydrocarbons from mixtures of aromatic hydrocarbons and non-aromatic hydrocarbons by extraction with a solvent, characterized in that it comprises the steps of: introducing the hydrocarbonaceous mixture in an intermediate point of a counterflow extraction system and introducing at one end of said extraction system a solvent essentially consisting of formylmorpholine and, from the opposite end, a refluxing agent essentially consisting of a light paraffin fraction having a boiling point substantially lower than that of the hydrocarbons contained in the hydrocarbonaceous mixture, while maintaining the phases in mutual contact at a temperature between 20° C. and 90° C., discharging a refined stock substantially devoid of aromatic hydrocarbons and of solvent from the same end of the system wherein the solvent is introduced, discharging an extract formed by the solvent, the aromatic hydrocarbons and a portion of the refluxing agent and substantially free of the non-aromatic hydrocarbons fed-in with the hydrocarbonaceous mixture, subjecting the extract thus obtained to washing within a counterflow contact system with a light paraffin fraction having a boiling point definitely lower than that of the aromatic hydrocarbons present in the extract, discharging from the contact system in which the washing is carried out a heavier phase consisting of all the solvent and substantially free of hydrocarbons, and discharging from the opposite end a hydrocarbonaceous phase consisting of the solvent-freed aromatic hydrocarbons extracted from the hydrocarbonaceous mixture and light paraffin hydrocarbons having a boiling point substantially lower than that of the more volatile aromatic hydrocarbon present in the system, separating the extracted aromatic hydrocarbons and light paraffin hydrocarbons having a boiling point substantially lower than that of the more volatile aromatic hydrocarbon present in the system from the solvent-freed extract by evaporation under such conditions as to evolve therefrom a major aliquot of the low-boiling light paraffin fraction which is utilized as a refluxing agent again and as a washing agent, separating thereafter from the residual extract the remainder of the light paraffin fraction along with a portion of the more volatile aromatic hydrocarbon as a stream, mixing said stream obtained with the feed to the extraction system and not as a reflux, and obtaining as a bottom product a hydrocarbonaceous fraction consisting of substantially pure aromatic hydrocarbons the temperature being maintained between 20° C. and 90° C. throughout the whole process.

2. A process according to claim **1**, wherein the solvent essentially consists of formylmorpholine containing water in an amount from 0.5% to 10% by volume.

3. A process according to claim **1**, for the extraction of benzene, toluene, xylenes and ethylbenzene from hydrocarbonaceous mixtures containing them, wherein the light paraffin fraction employed for refluxing and washing essentially consists of pentane.

4. A process according to claim **1**, for the extraction of benzene, toluene, xylenes and ethylbenzene from hydrocarbonaceous mixtures containing them, wherein the light paraffin fraction employed for refluxing and washing essentially consists of butane.

5. A process according to claim **1**, wherein the extraction and the washing are carried out at a pressure sufficient to maintain all of the contacted phases in a condensed condition.

6. A process according to claim **1**, wherein the refined stock obtained by extraction is subjected to distillation for separating the light paraffin fraction coming from the refluxing stage and utilizing it as such again.

7. A process according to claim **1**, wherein the traces of solvent present in the refined stock and in the solvent-freed extract are recovered by washing with water.

8. A process according to claim **1**, wherein the volume ratio of the solvent to the fed-in stock is between 1 to 1 and 5 to 1.

9. A process according to claim **1**, wherein the volume ratio of the feed stock and the non-aromatic reflux at the extraction stage is between 0.15 to 1 and 0.7 to 1.

10. A process according to claim **1**, wherein the ratio by volume of the solvent to the light paraffin fraction employed for washing the extract is between 0.5 to 1 and 1.2 to 1.

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