



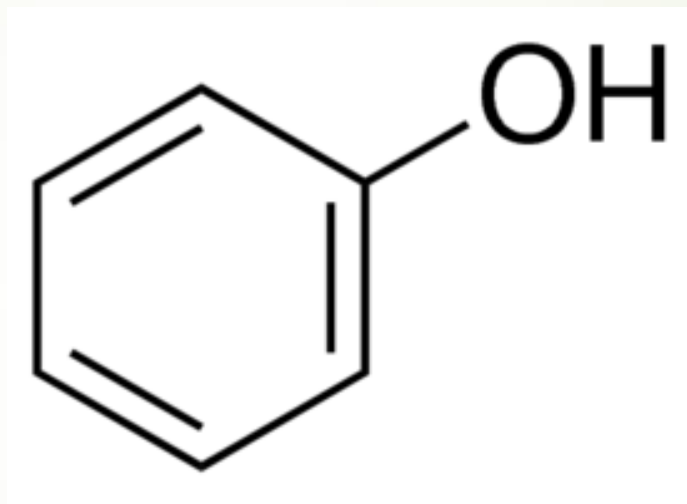
Two component systems containing liquid phases



Tracking a compound

2

➤ Phenol structure



➤ Is it acidic or basic?

Tracking results

3

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Tracking results

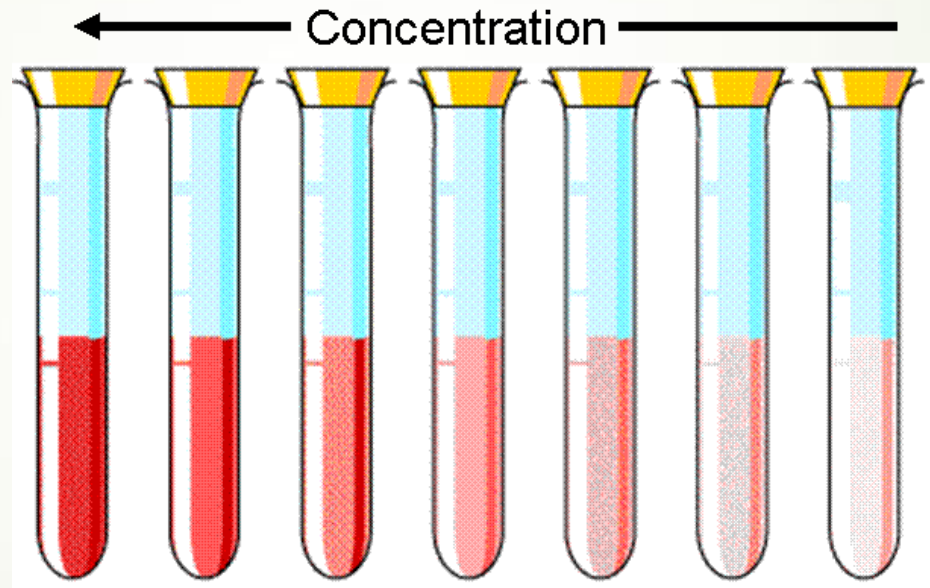
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- 1. Acidic
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

phenol

5

- **Affinity to water**, mixing by several proportions like (2,7,9,11,24,40,55,63,70,75) w/w% concentrations



- Q/Why using (w/w% concentrations?)

Tracking results

6

1. Acidic
2. Contractible with water due to H bonding
3.
4.
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Miscibility with water

7

- Would it be (miscible or immiscible)?
- Would it be miscible with water in **other temperatures** . For the prepared concentrations (2,7,9,11,24,40,55,63,70,75) w/w%?

Miscibility with water

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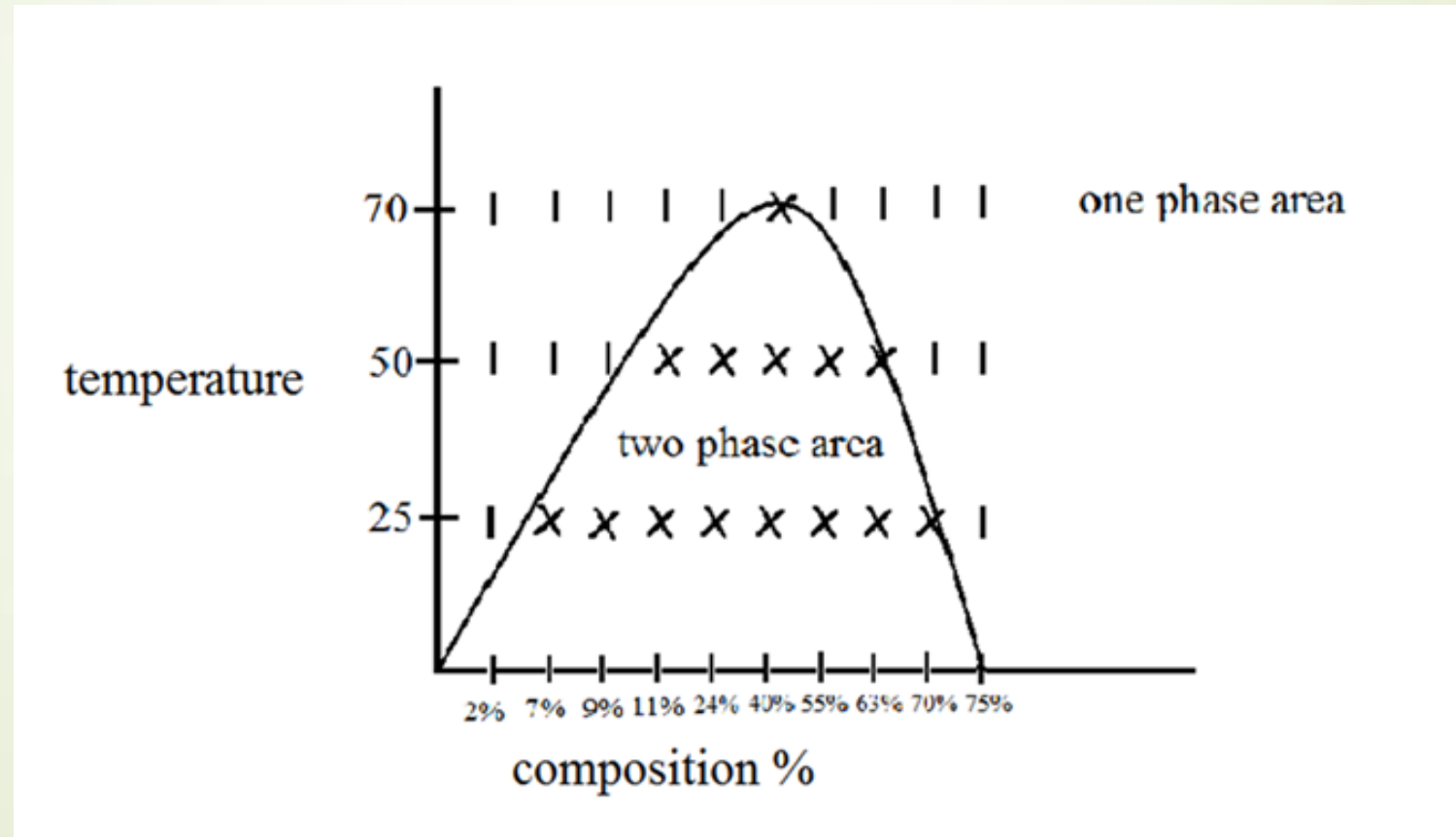
- Would it be (miscible or immiscible)?
- Would it be miscible with water in **other temperatures** . For the prepared concentrations (2,7,9,11,24,40,55,63,70,75) w/w%?

| %Weight /tempC° | 25 | 40 | 50 | 70 |
|--------------------|----|----|----|----|
| 2 | | | | |
| 7 | | | | |
| 9 | | | | |
| 11 | | | | |
| 24 | | | | |
| 40 | | | | |
| 55 | | | | |
| 63 | | | | |
| 70 | | | | |
| 75 | | | | |

Miscibility with water

9

- Would it be (miscible or immiscible)?
- Would it be miscible with water in **other temperatures** . For the prepared concentrations (2,7,9,11,24,40,55,63,70,75) w/w%?



Phenol's affinity to water

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- Would it be (miscible or immiscible), discuss the following diagram?

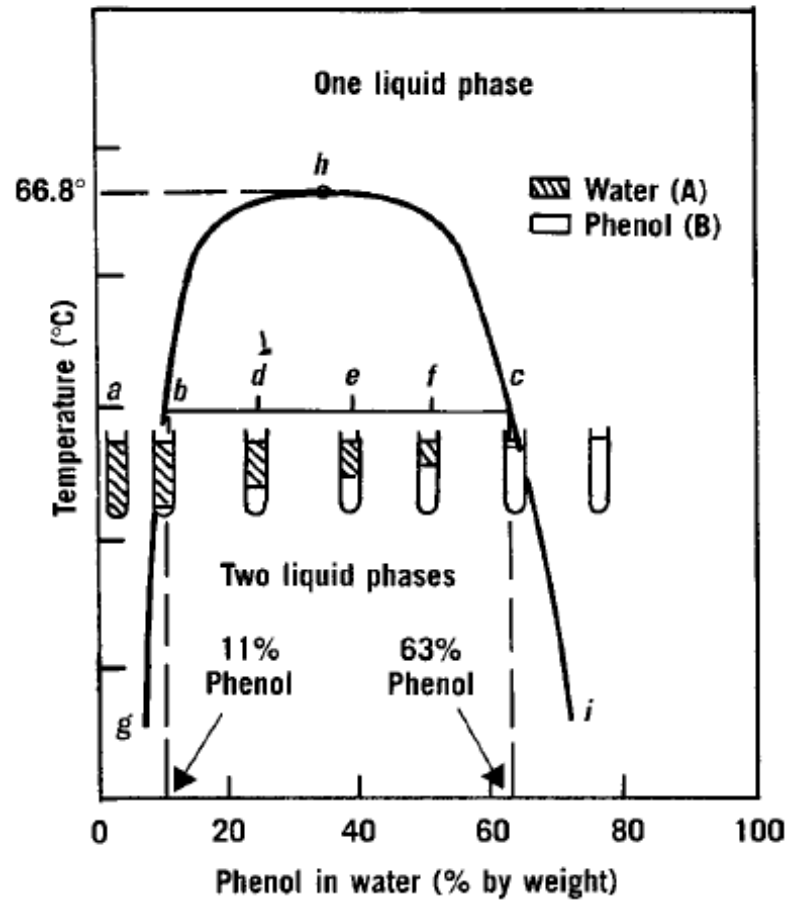


Fig. 2-23. Temperature-composition diagram for the system consisting of water and phenol.

Tracking results

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1. Acidic
2. Contractible with water due to H bonding
3. Has one phase area , and two phase area (Phase means what?)
4.
5.
6.
7.
8.
9.
10.

The Phase

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- What does phase mean?
- homogeneous, and physically distinct portion of a system that is separated from other portions of the system by bounding surfaces

At two phase area

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- When it is not miscible, would it **distribute** to the other phase?
- If that happened by what proportion, under what temperature?



At two phase area

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- When it is not miscible, would it **distribute** to the other phase?
- If that happened by what proportion, under what temperature?
- The answer is: the **(TIE LINE)**

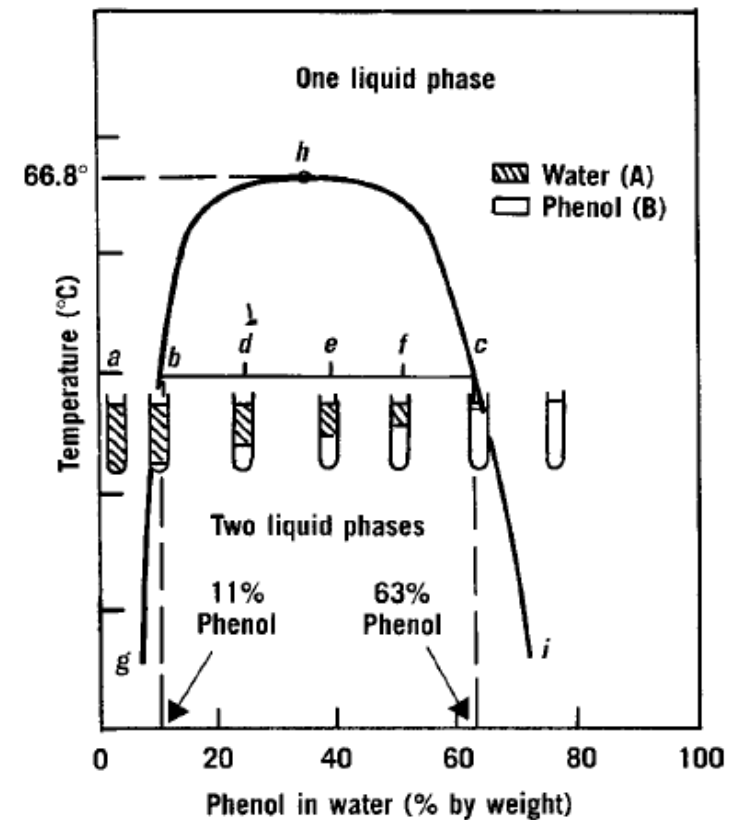


Fig. 2-23. Temperature-composition diagram for the system consisting of water and phenol.

Tracking results

15

1. Acidic
2. Contractible with water due to H bonding
3. Has one phase area , and two phase area (Phase means what?)
4. Tie line: a line parallel to the base containing systems with two phases at equilibrium, with constant distribution ratios. called (*conjugate phases*)
5.
6.
7.
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10.

Very special tie line

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- On tie line, solutions don't mix, but our compound distribute to the upper phase in special ratio **11%** while the remaining in the down is only **63%**, under special temperature 50°

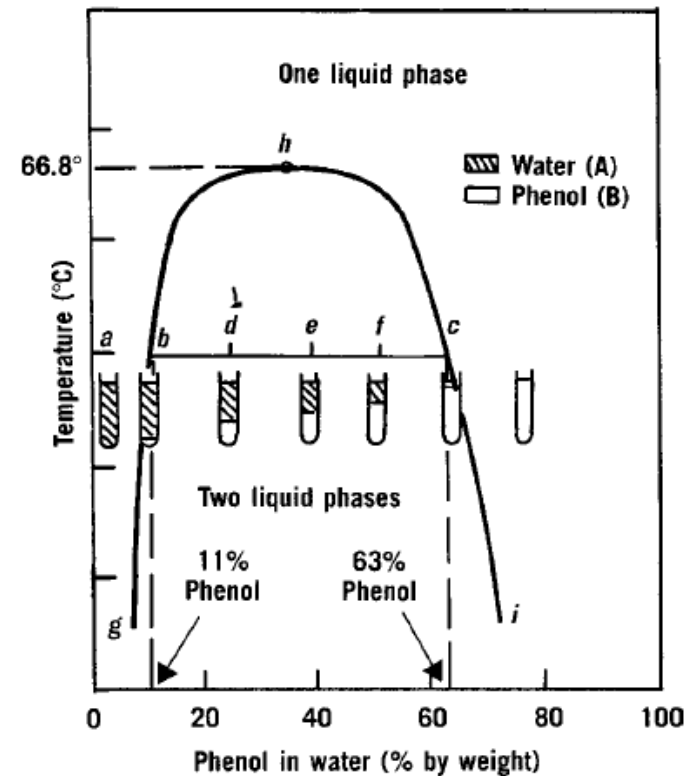


Fig. 2-23. Temperature-composition diagram for the system consisting of water and phenol.

- Q/For all the concentrations the diffused is 11% of the mixed, the remaining 63% of the originally mixed (How about the other 26% of it?)
- Q/ **Only** on tie line system has two degrees of freedom (concentration and pressure independent)

Phase Rule

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- What is the degree of freedom?
- The number of variables that the system has no dependence on, don't change its equilibrium when they vary.
- **The phase rule**

$$F = C - P + 2$$

- **F**: degree of freedom
- **C**: number of components
- **P**: number of phases

The phase rule

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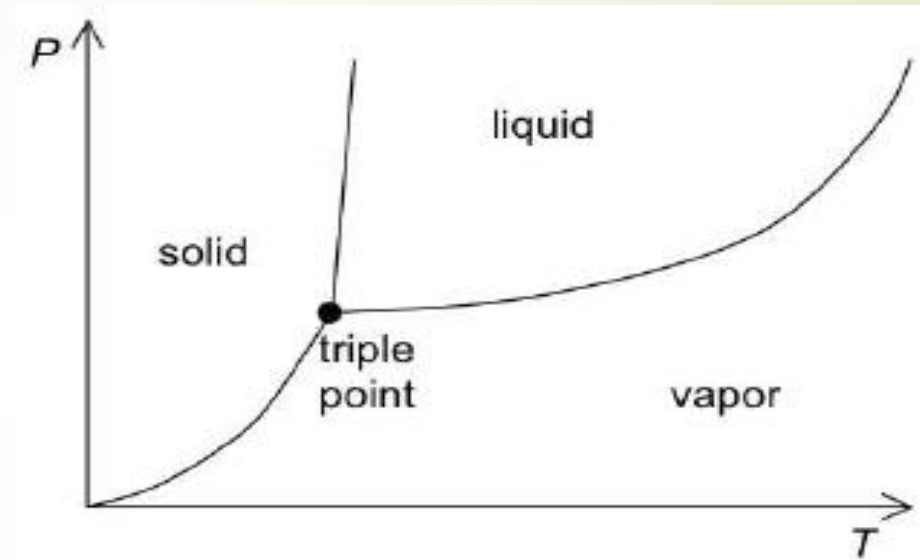
➤ Water triple point

➤ $F = C - P + 2$

➤ $F = 1 - 3 + 2$

➤ $F = 0$

➤ This means water system at this point of equilibrium is very sensitive and depends on all the variables (has no freedom)



Tracking results

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1. Acidic
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4. Tie line: a line parallel to the base containing two phases all systems equilibrium, contains phases of constant distribution ratios. called (*conjugate phases*)
5. The *number of degrees of freedom* is the *least* number of intensive variables that must be fixed/known to describe the system completely
6.
7.
8.
9.
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- So on the tie line the system has no dependency on concentration nor pressure.
- While the distribution ratio and equilibrium are at steady state

Back to tracking phenol

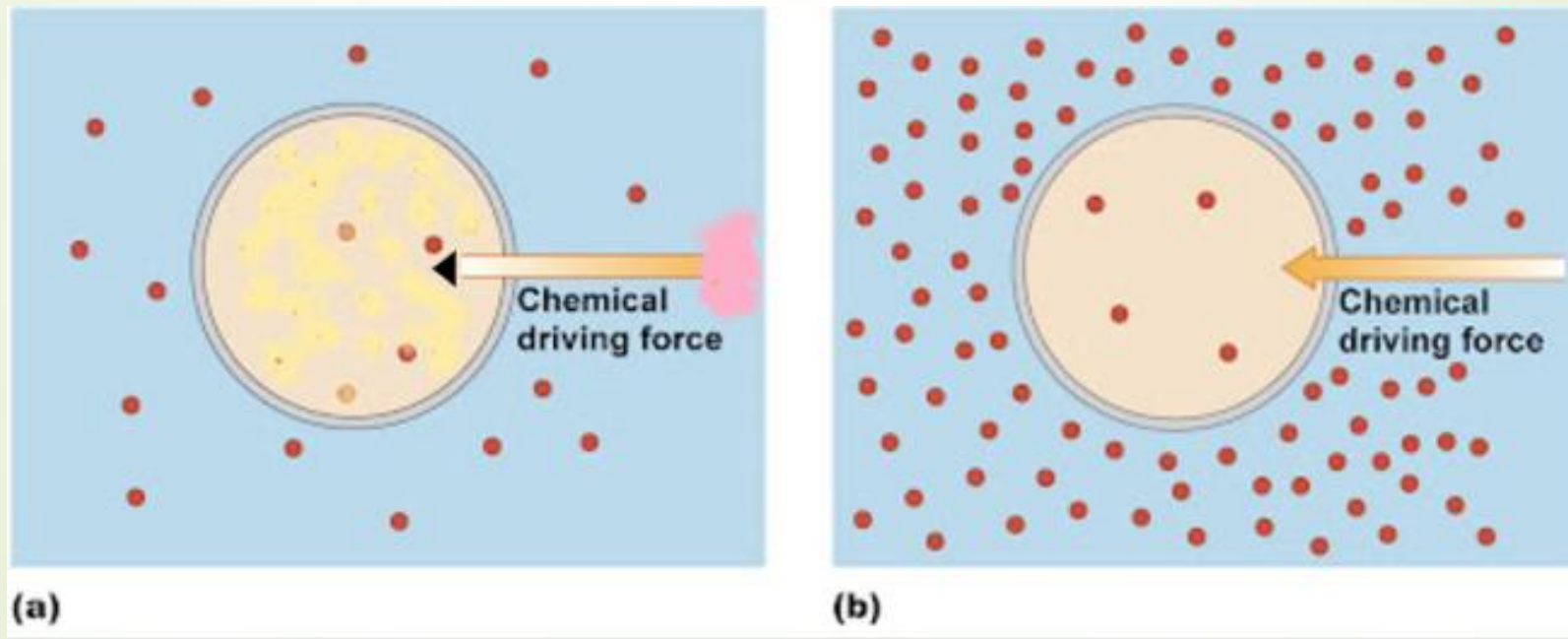
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- (Before) mixing: the molecule of phenol (C_6H_6O) was found (or carried) in its original phase surrounded along with lead, some volatiles and chloride...under definite concentration
- (After) mixing when the distribution occurs. Is the carrying phase would have the same volume? same concentration? Or the same ability to cross cell membrane as an example?

Effect of Concentrations on the cell entrance

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- No, when distribution occurs, volumes and, concentrations change, then the ability of the molecule to penetrate a cell membrane will change correspondingly



- From the diagram how to use it to find the final volume of phase that carry our compound?
- The system at (d) point before equilibrium was prepared by adding 2.4 g phenol (phase A) to 7.6 g of water (phase B)
- Before equilibrium Phase A (2.4 g) : Phase B (7.6 g)
- After equilibrium Phase A (2.5 g) : Phase B (7.5 g)
- After distribution and equilibrium (phase A) became 2.5 g while phase B became 7.5 g

- The system at (d) point before equilibrium was prepared by adding 2.4 g phenol (phase B) to 7.6 g of water (phase A)
- Before equilibrium Phase B (2.4 g) : Phase A (7.6 g)
- After equilibrium Phase B (2.5 g) : Phase A (7.5 g)
- Depending on the limits of the tie line (11% and 63%),

$$d = 63 - 24 / 24 - 11$$

$$d = 39 / 13$$

$$d = 3 / 1$$

$$d = 7.5 / 2.5$$

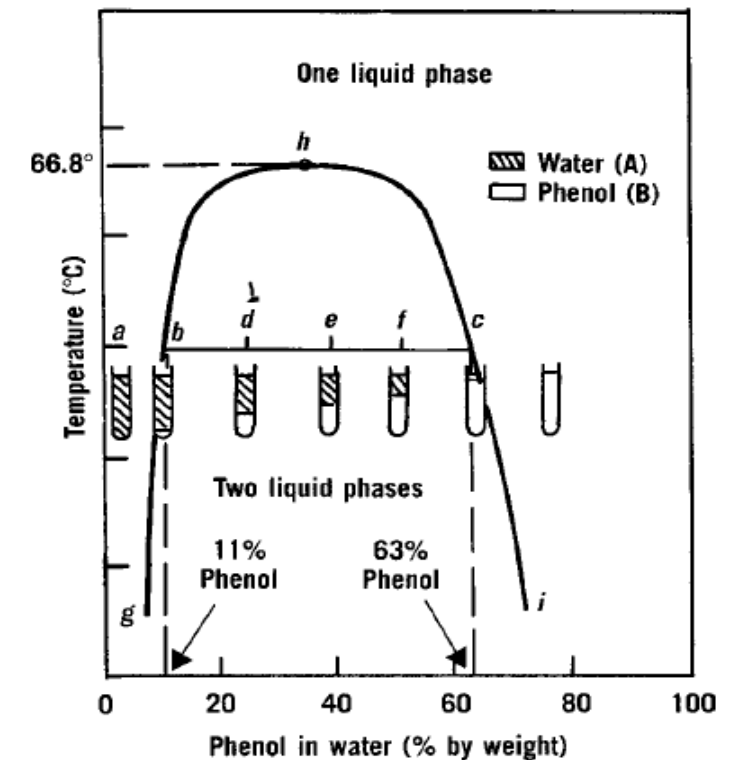


Fig. 2-23. Temperature-composition diagram for the system consisting of water and phenol.

- For point (f) before equilibrium A phase 5 g : B phase 5 g
- After equilibrium :

$$f = 63 - 50 / 50 - 11$$

$$f = 13/39$$

$$f = 1/3$$

$$f = 2.5 / 7.5$$

For point (f) after equilibrium
A phase 2.5g : B phase 7.5g

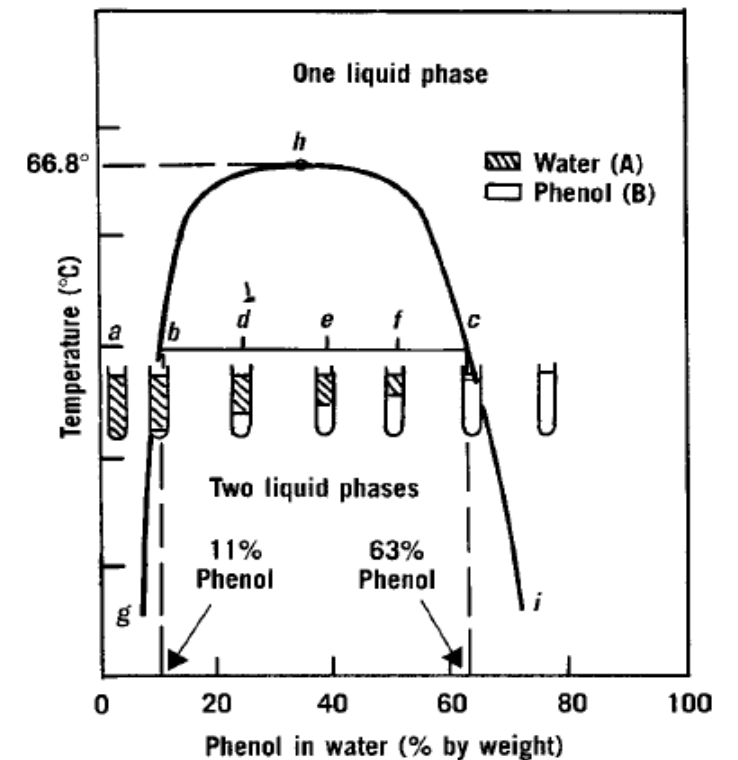


Fig. 2-23. Temperature-composition diagram for the system consisting of water and phenol.

Tracking results

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3. Has one phase area , and two phase area (Phase means what?)
4. Tie line: a line parallel to the base containing two phases all systems equilibrium, contains phases of constant distribution ratios. called (*conjugate phases*)
5. The *number of degrees of freedom* is the *least* number of intensive variables that must be fixed/known to describe the system completely
6. Phase diagram can provide the new system volumes and concentrations

Home Work

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- Search for: (Importance of phase diagram in Pharmacy)
- One page only supported by references. Best regards

Experimental Procedure

- 1. Prepare (2,7,9,11,24,42,55,63,70,75)% by volume phenol in water
- 2. Take 10ml from the all concentrations in test tubes
- 3. Make these test tubes in the water bath in (room temp. 25,40,50,70)°C through
- 10 min
- 4. Record these solutions is one phase (/) or two phase(+)
- 5. Draw the diagram

References

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- **Martins, Physical Pharmacy and pharmaceutical sciences, 6th Ed**