* Steam Distillation *

> it's not always Easy, but that's life.
> Be Strong because there are
> better days ahead !! ♥♥...

(Steam distillation) A Method for purification and Seperation of Liquid and Solid.

* أخذنا بالقرية اللي قبل كيف ممكن أعمل

Recrystallization ← Solid الـ عن طريق ← purification الـ

Extraction.. ← Liquid عن طريق الـ

تنقية + فصل للسائل والصلب ← Steam distillation

باستخدام بُخار الماء.

* المادة المُذيبة هي الماء فقط.
  the only Solvent is water vapor

استخدامه واضحة ← لأن الـ Solvent موسام وماعندي مواد كيميائية..
So it is available :-

Steam distillation is the distillation of $\boxed{1}$ **Slightly Volatile**, $\boxed{2}$ **water-insoluble**
substances by means of Steam.

المواد اللي بدي أفصلها -

For Mixture of two Completely immiscible Compound A and B,
the total Vapor pressure (Pт) Can be expressed, as usual,
in terms of partial pressures PA and PB.

$$\boxed{P_T} = \underline{\underline{P_A}} + \underline{\underline{P_B}} = P_A^\circ \cdot X_A + P_B^\circ \cdot X_B$$

لما يكون الضغط الداخلي مساوي للخارجي
رح يبدأ يتبخر

Solvent   Analyte: the Substance whose chemical
Constituents are being identified and Measured

A and B → **immiscible.**

independently ← $X_a = X_b = 1$

X_a, X_b
Mole Fraction
A, B → liquid

* مثل ما حكينا إنه الـ X_a ، X_b ، كُل System منفصل لحاله !!

** بأثّروا بشغلات وبعده ← عملية تكوّن الـ molecules المتطايرة هي المادتين رح يتبخروا ويبردوا من الضغط لأن مادتين موجبة بالتالي علبة التسخين هارج بغلي وبتطلبرعلى ١٠٠ رح يكون أقل .

فمثل مادة بتطلع بلوط مستقل لأن كل ما حكينا هم بالنهاية ← immiscible

$$P_t = \underline{\underline{P_A + P_B}} = \underline{\underline{P_A^o + P_B^o}} = \text{Constant}.$$

* بزاد وجهة منهم مش ، الـ P_t رح تحود على المادة الأُخرى .

* مُعلومات سريعة :)

1. the total $\overset{vapor}{\text{pressure}}$ of Such a <u>heterogeneous</u> (two phase) Mixture

<u>homo</u> معهم أخوان هم هو

is <u>Constant</u> + depend only on the <u>vapor pressure</u> of <u>pure A</u>
and <u>pure B at given temp.</u>

2. the vapor pressures are Completely <u>independent</u> of the relative
amounts of <u>A</u> and <u>B</u> in the Mixture.

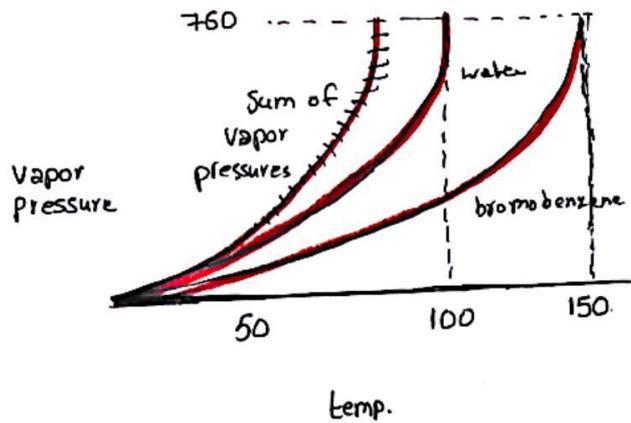* إلا بحالة وجهة مثل ما حكيت X

    * Unless either P_A^o or P_B^o is → Zero

    * the vapor pressure of the <u>Mixture</u> (at given temp.)
    is <u>higher</u> than the vapor pressure of either Component <u>alone.</u>

Vp Mixture > Vp alone

3. the b.p of the Mixture ⇒ the temp. at which the total vapor press
      ↳ equals → <u>atmospheric pressure</u>

* it is Obviously <u>lower</u> than the b.p of either pure A or B.

Vapor Pressure

760

Sum of Vapor pressures

water

bromobenzene

50   100   150

temp.

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independently.

* الـ bromobenzene والـ water
لمّا يكون كل واحد لحال رح تكون درجة الغليان أعلى

* المُفاجئ اللي مخرِّش عليه 😀
هاد لمّا يكونوا الـ 2 مع بعض ..
فرح يبلّش يغلي على درجة حرارة أقل .

* رح يبدأ يتبخر من كل مادّة (من طرفين) ومع زيادة درجة الحرارة ← رح نزيد الـ ptotal لأنها لخّنها من مادتين
حتى يتساوى مع الـ External وبدا يبيّن كميّاته من A و B على درجة حرارة أقل من كل وحدة كل .

* (نفس مبدأ الـ Anti / freeze) بدل ما يجمد عن zero رح يجمد على -20

Steam distillation → purification of high b.p compound
by low temp. distillation and so replaces vacum distillation.

* disaduantage : it is limited to Substance

شروط ..
- ✓ ① Steam - Volatile ⟶ appreciable vapor pressures at the temp. of Steam distillation
                                                    90 - 95°C
- ✓ ② Immiscible with water
- ✓ ③ inert toward Steam and (يبطا جزئ لو طيار نطبأ)

Stable Under the Condition of Steam distillation.

Steam distillation application
تطبيقات .

→ Seperation of Such Compound from Mixture Containing (non volatile impurities) ➟ flavors الـ مثل الحلويات والـ

→ isolation of Steam - Volatile Organic Compound from natural Sources (plant)

مؤثّرها liquid نحنا ما حكينا بالبداية ممكن تكون Solid
بس لازم يتوفّروا الشروط الـ ③

$$\frac{\text{Moles of A}}{\text{Moles of B}} \ (\text{in Vapor}) = \frac{P_A}{P_B} = \frac{P_A^\circ \cdot x_A}{P_B^\circ \cdot x_B} = \frac{P_A^\circ}{P_B^\circ} \quad , \ \underline{\text{At equilibrum}}$$

Steam distillation → temp. below the b.p of water

make it possible to distil high-boiling, Steam-volatile, organic compound

at temp. below $100\,^\circ C$.

↓

Avoiding possible decompo
of Such compo
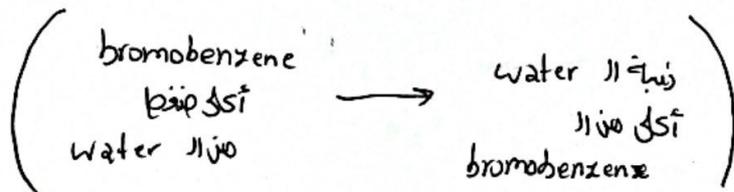
* **the ratio of A and B in the vapor**

will depend not only on their <u>Molar ratios</u>, but also on <u>their M.M</u>

the M.M of the Organic Substance → higher than water

Significant amounts of the Organic Substance will distil over

it's Vapor pressure → Low

* عدد كتلات لـ A و B

مقسومة علي الوزن الجزيئي لـ (A و B)

$$\boxed{\frac{\text{Weight of A}}{\text{Weight of B}} = \frac{P_A^\circ \ (Mw)_A}{P_B^\circ \ (Mw)_B}}$$

$$\left(\begin{array}{ccc} \text{bromobenzene} & & \text{water زيت الـ} \\ \text{أكثر ضغط} & \longrightarrow & \text{أكثر من الـ} \\ \text{water زيت الـ} & & \text{bromobenzene} \end{array}\right)$$

* ليه؟ لأن الـ P° لـ Bromobenzene أكثر من الـ water

$$\boxed{\begin{array}{l} M.w \uparrow \longrightarrow P^\circ \ \text{بن أكثر} \longleftarrow \text{توابعها بالاحتباس} \\ \text{رح تكون أقل} \quad \text{أضغاط واراة سائلة.} \end{array}}$$

Saja dwaikat ..
Good luck!

ESSENTIAL OILS

The characteristic aromas of plants are due to volatile essential oils, which are used as a source of fragrances and flavorings. These oils occur in all parts of the plant. Essential oils are generally complex mixtures of hydrocarbons, alcohols, and carbonyl compounds, mostly belonging to the broad group of plant products known as terpenes.

Essential oils are best isolated from the plant tissue by steam distillation. In this experiment, the essential oil of one of four widely used spices (anise, caraway, cumin and cloves) will be isolated by steam distillation.

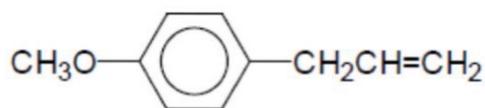**Anise Oil.** The essential oil obtained from anise, a popular flavoring for cookies:

➤ is predominantly *trans*-1-(*p*-methoxyphenyl)propene (*anethole*) which comprises 80-90% of the oil.

$$CH_3O-\langle\bigcirc\rangle-CH=CHCH_3$$
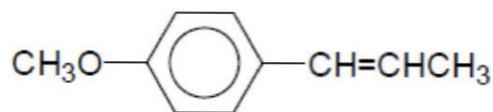
anethole

➤ A minor component is the double bond isomer, 3-(*p*-methoxyphenyl) propene (*p-allylanisole*).

➤ Anethole has a melting point near room temperature, and the oil crystallizes on chilling.

$$CH_3O-\langle\bigcirc\rangle-CH_2CH=CH_2$$

p-allylanisole