



PENYIMPANAN PADA ATMOSFER TERKENDALI

Oleh:

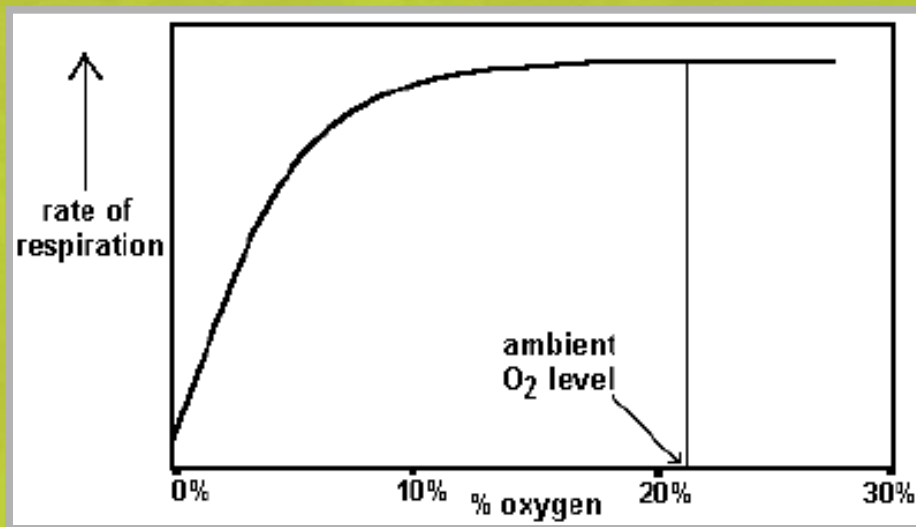
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JURUSAN ILMU DAN TEKNOLOGI PANGAN
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SURAKARTA

PENGARUH KOMPOSISI UDARA TERHADAP KECEPATAN RESPIRASI

- **Konsentrasi O_2**



Pada saat konsentrasi O_2 kurang dari 10% kecepatan respirasi menurun, namun pada konsentrasi O_2 2% respirasi yang berlangsung adalah respirasi anaerob.

- **Konsentrasi CO₂**

- Semakin tinggi, maka kecepatan semakin rendah
- Pada kadar 20% → respirasi anaerob
→ kerusakan jaringan

- **Konsentrasi CO**

- Konsentrasi 1-10% menurunkan laju, tetapi jika >10% menaikkan laju pada buah klimaterik

PENGHAMBATAN RESPIRASI



MODIFIED AND CONTROLLED ATMOSPHERE



"Controlled atmosphere" and "modified atmosphere" are terms implying the addition or removal of gases from storage rooms, transportation containers or packages in order to manipulate the levels of gases such as oxygen, carbon dioxide, nitrogen, ethylene etc., and achieve an atmospheric composition different to that of normal air around the food (Floros, 1990).

CONTROLLED ATMOSPHERE STORAGE (CAS)

NORMAL STORAGE

CAS

Normal atmosfer

O₂ : 21 %
CO₂ : 0.03 %
N₂ : 78%



CAS

O₂ : 5 %
CO₂ : 3 - 12 %
N₂ : ?



KEUNTUNGAN:

- Secara umum dapat memperpanjang umur simpan dibandingkan penyimpanan biasa maupun penyimpanan dingin saja tanpa kombinasi CA
- Buah-buah yang sedikit lewat masak dapat disimpan lama tanpa mengurangi umur simpan
- Mengurangi sensitivitas buah terhadap ethylene maupun chilling injury pada suhu dibawah suhu optimum
- Menurunkan resiko serangan serangga, hama, dan jamur

METODE

- Biarkan buah melakukan respirasi untuk menghasilkan CO_2 dan menurunkan O_2 . ketika CO_2 telah mencapai konsentrasi yang diinginkan, kondisi ini dijaga konstan.
- Ketika O_2 turun, inlet dibuka untuk memasukkan udara segar
- Proses memasukkan udara segar (3-4 kali/jam) memerlukan pengalaman yang cukup

MODIFIED ATMOSPHERE PACKAGING (MAP)

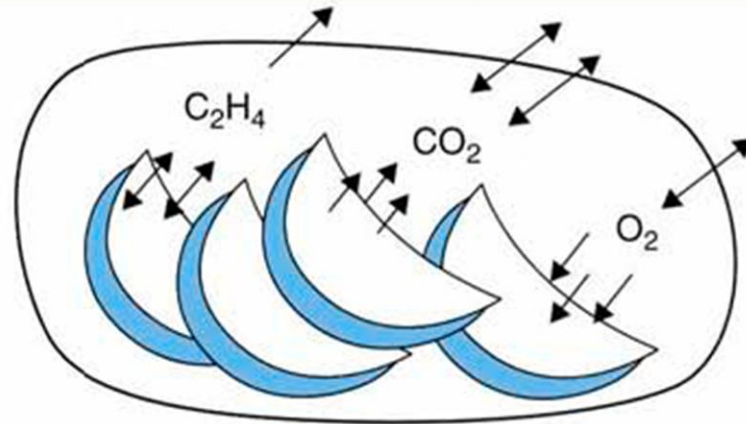


Figure 10.1 Gas exchange between a product and its surrounding atmosphere in a permeable package.



KEUNTUNGAN

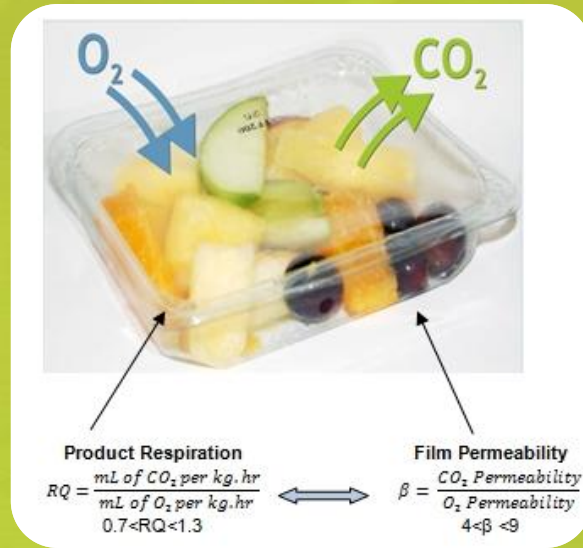
To the consumers:

it offers convenient, high-quality food products with an extended shelf life. It also reduces and sometimes eliminates the need for chemical preservatives, leading to more "natural" and "healthy" products.

To the producers:

The producers enjoy the benefits of increased shelf life. By using MAP many products can be packaged centrally, and their distribution cost is reduced because fewer deliveries over longer distances become possible. Moreover, because of the extended shelf life, MAP allows transportation of foods to remote destinations and increases product markets.

PERALATAN UNTUK MAP



QUALITY ASSURANCE

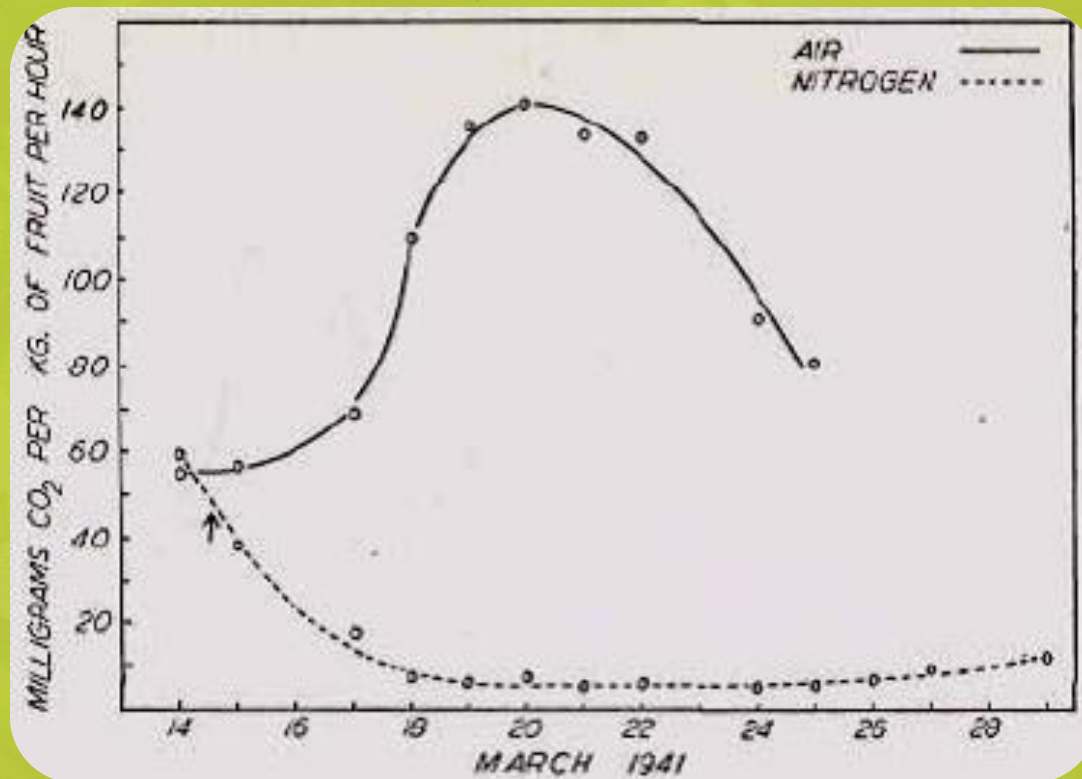


Incorrect oxygen levels, empty gas cylinders and bad sealing bars can cause imprecise gas blends and poor package seals that can result in product spoilage. Routine package testing with headspace gas analyzer, on-line gas analyzer and leak detectors assures package quality, hence helps ensuring the shelf life.

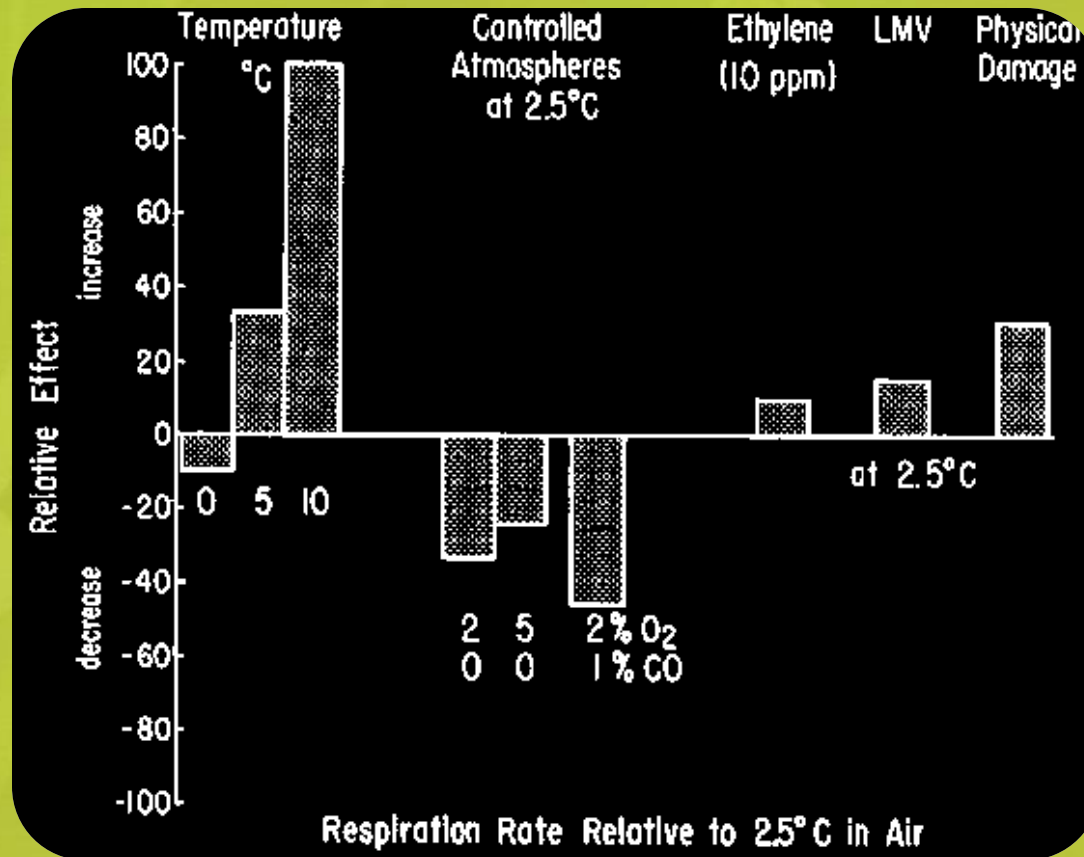
COMBINATION OF MAP

- 1. Refrigeration**
- 2. Freezing**
- 3. Irradiation**
- 4. Hurdle technology**
- 5. Edible coating**
- 6. Biological Control**

PENGARUH PERLAKUAN NITROGEN TERHADAP KECEPATAN RESPIRASI



PENGARUH *MODIFIED/CONTROLLED ATMOSPHERES* TERHADAP PENGHAMBATAN RESPIRASI DIBANDING PERLAKUAN LAIN



-100
-80

KONDISI *MODIFIED/CONTROLLED ATMOSPHERE* OPTIMUM PADA KOMODITAS **ALPUKAT**

Avocado (*Persae americana* Mill.)

Optimum temperature: 10°C, expected range: 5–13°C

Modified atmosphere considerations:

	Reduced O ₂	Increased CO ₂
Beneficial level:	2–5 %	3–10%
Benefits:	Delayed ripening, reduced rates of CO ₂ and C ₂ H ₄ production	Delayed softening, reduced chilling injury symptoms
Potential for benefits:	Good	Good
Injurious level:	< 1%	> 15%
Injury symptoms:	Off-flavour, internal flesh browning	Skin browning, off-flavours
Potential for injury:	Moderate	Moderate

Commercial use or potential: Use during long-distance transport is expanding.

Remarks: CO at 5–10% added to CA may be useful in reducing decay problems. Exposure to 25–30% CO₂ for 2–3 days can delay decay incidence during subsequent storage in air or CA. Exclusion and/or removal of ethylene (<1 ppm) from air or CA storage are recommended.

KONDISI *MODIFIED/CONTROLLED ATMOSPHERE* OPTIMUM PADA KOMODITAS **PISANG**

Banana (*Musa spp.*)

Optimum temperature: 14°C, expected range: 12–16°C

Modified atmosphere considerations:

	Reduced O ₂	Increased CO ₂
Beneficial level:	2–5 %	2–5%
Benefits:	Delayed ripening	Delayed ripening
Potential for benefits:	Very good	Very good
Injurious level:	< 1%	> 7%
Injury symptoms:	Dull yellow or brown skin discoloration, failure to ripen, off-flavours	Green fruit softening undesirable texture & flavour
Potential for injury:	High	Moderate to high
Commercial use or potential:	Use during long-distance transport is expanding. Modified atmospheres (1–5% O ₂ and 4–6% CO ₂) and/or ethylene-absorbers are also used commercially during transport and distribution.	

Remarks: Cooking bananas and plantains have similar CA requirements

KONDISI *MODIFIED/CONTROLLED ATMOSPHERE* OPTIMUM PADA KOMODITAS **MANGGA**

Mango (*Mangifera indica* L.)

Optimum temperature: 13°C, expected range: 10–15°C

Modified atmosphere considerations:

	Reduced O ₂	Increased CO ₂
Beneficial level:	3–5% (5–7% SE Asia-grown varieties)	5–10%
Benefits:	Delayed ripening	Firmness retention
Potential for benefits:	Moderate	Slight to moderate
Injurious level:	< 2% (< 5%)	> 10%
Injury symptoms:	Skin discoloration, off-flavours greyish flesh colour	Off-flavours, softening,
Potential for injury:	Moderate	Moderate
Commercial use or potential:	Limited use of 5% O ₂ + 5% CO ₂ + 5–10% CO during marine transport.	

Remarks: Avoiding chilling injury is important when CA is used. Use of heat treatments to reduce anthracnose is highly recommended.

KONDISI *MODIFIED/CONTROLLED ATMOSPHERE* OPTIMUM PADA KOMODITAS **PEPAYA**

Papaya (*Carcia papaya* L.)

Optimum temperature: 12°C, expected range: 10–15°C

Modified atmosphere considerations:

	Reduced O ₂	Increased CO ₂
Beneficial level:	2–5%	5–8%
Benefits:	Delayed ripening (degreening and softening)	Firmness retention
Potential for benefits:	Slight to moderate	Slight to moderate
Injurious level:	< 2%	> 8%
Injury symptoms:	Off-flavours, failure to ripen	Off-flavours, may aggravate chilling injury at < 12°C
Potential for injury:	Moderate	Moderate
Commercial use or potential:	None at this time; waxing may be used to modify internal O ₂ and CO ₂ concentrations.	

Remarks: Chilling injury should be avoided when CA is used. Prestorage treatments to minimise decay during storage are essential to successful storage.

KONDISI *MODIFIED/CONTROLLED ATMOSPHERE* OPTIMUM PADA KOMODITAS **RAMBUTAN**

Rambutan (*Nephelium lappaceum* L.)

Optimum temperature: 10°, expected range: 8–15°C

Modified atmosphere considerations:

	Reduced O ₂	Increased CO ₂
Beneficial level:	3–5%	7–12%
Benefits:	Retardation of senescence, lower respiration rate	Retarded red colour loss, extended postharvest life to about one month if water loss is minimised
Potential for benefits:	Slight	Moderate
Injurious level:	< 1%	> 20%
Injury symptoms:	Increased decay incidence	?
Potential for injury:	High	?

Commercial use or potential: Modified atmosphere packaging has potential for maintaining quality.

Remarks: Maintenance of high relative humidity is essential to minimising water loss and darkening of the skin.

TERIMA

KASIH