

SIKLUS NUTRIEN (NITROGEN) DAN REKAYASA PENYISIHAN AMONIA

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Program Studi Akuakultur FPIK UNMUL

PENTINGNYA MEMAHAMI SIKLUS NUTRIEN :

- 1. Nutrien sebagai limbah berbahaya bagi ikan itu sendiri**
- 2. Nutrien sebagai limbah sebenarnya bisa di konversi menjadi produk lain yang bernilai ekonomi**
- 3. Dengan memahami siklus nutrien dalam sistem akuakultur, maka kita bisa melakukan inovasi untuk meningkatkan kapasitas produksi.**

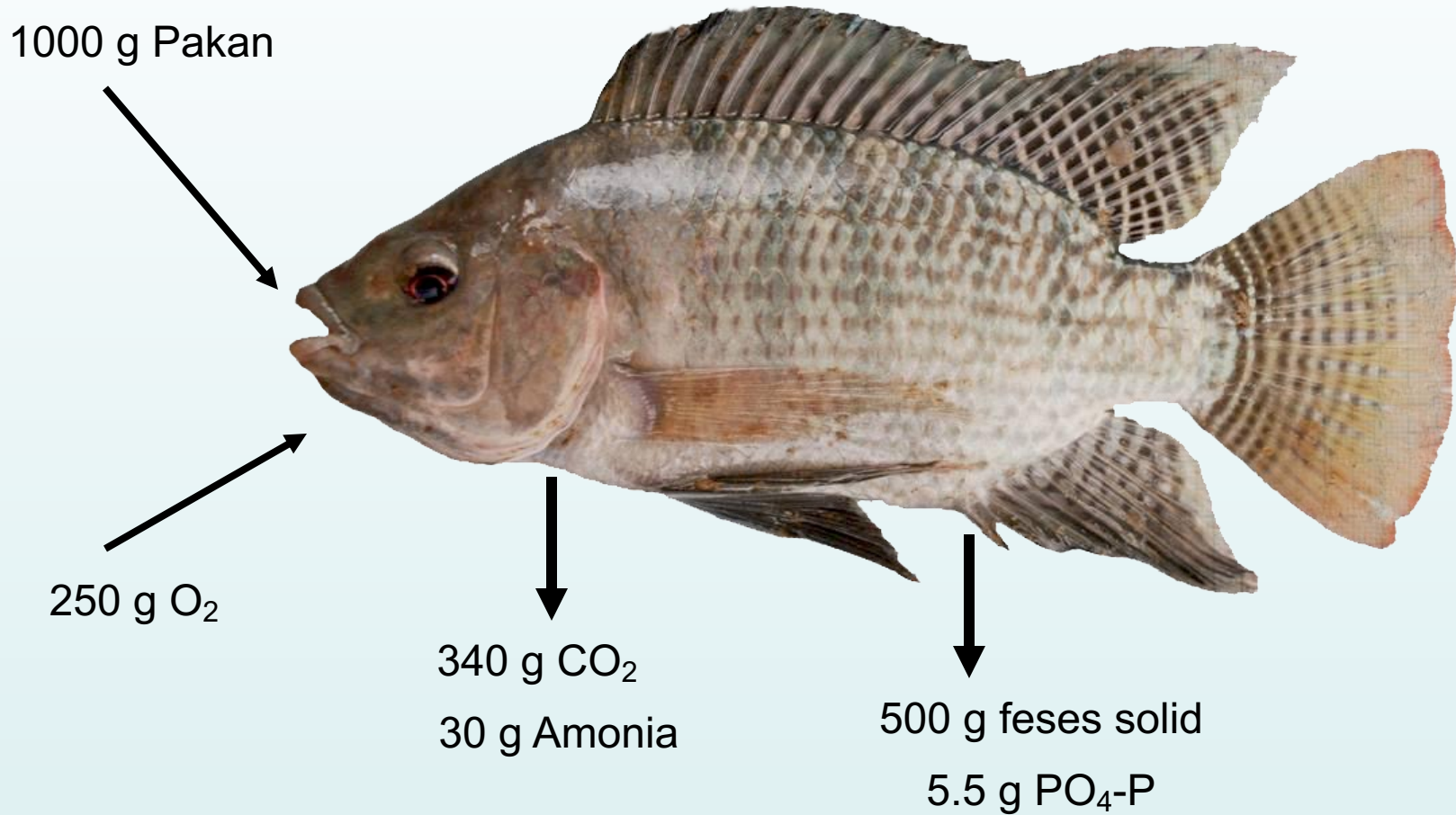
DINAMIKA NUTRIEN DALAM AKUAKULTUR TERPADU

Limbah berupa feses : 10-30% dan 30-65%

Limbah sisa metabolisme : 30-65 % dan 43 %

Nitrogen yang diretensi	Jumlah N dan P pakan yang dikonversi
Fish Biomass Converter	20-50 % dan 15-65 %
Phototrophic converter Herbivor (kerang)	60-85% dan 50-90% 2.3-13 % dan 2.3-4 %
Detrivorus (worm) converter	0.06 % dan 0.03×10^{-3}
Bakteria converter	7 % dan 6 %

Schneider. 2006. Analysis of nutrient flow in integrated intensive aquaculture system. *J. Aquacultural Eng.* 32 : 379-401



Colt. J. 1991. *Aquaculture Production System*. Journal of Animal Science : 69:4183-4192.



**FISH &
FOOD**

TO PLANTS & ATMOSPHERE



**CARBON
DIOXIDE (CO₂)
& AMMONIA
(NH₃)**



**NITROSOMONAS
BACTERIA**



**REMOVED BY
PLANTS &
WATER CHANGES**

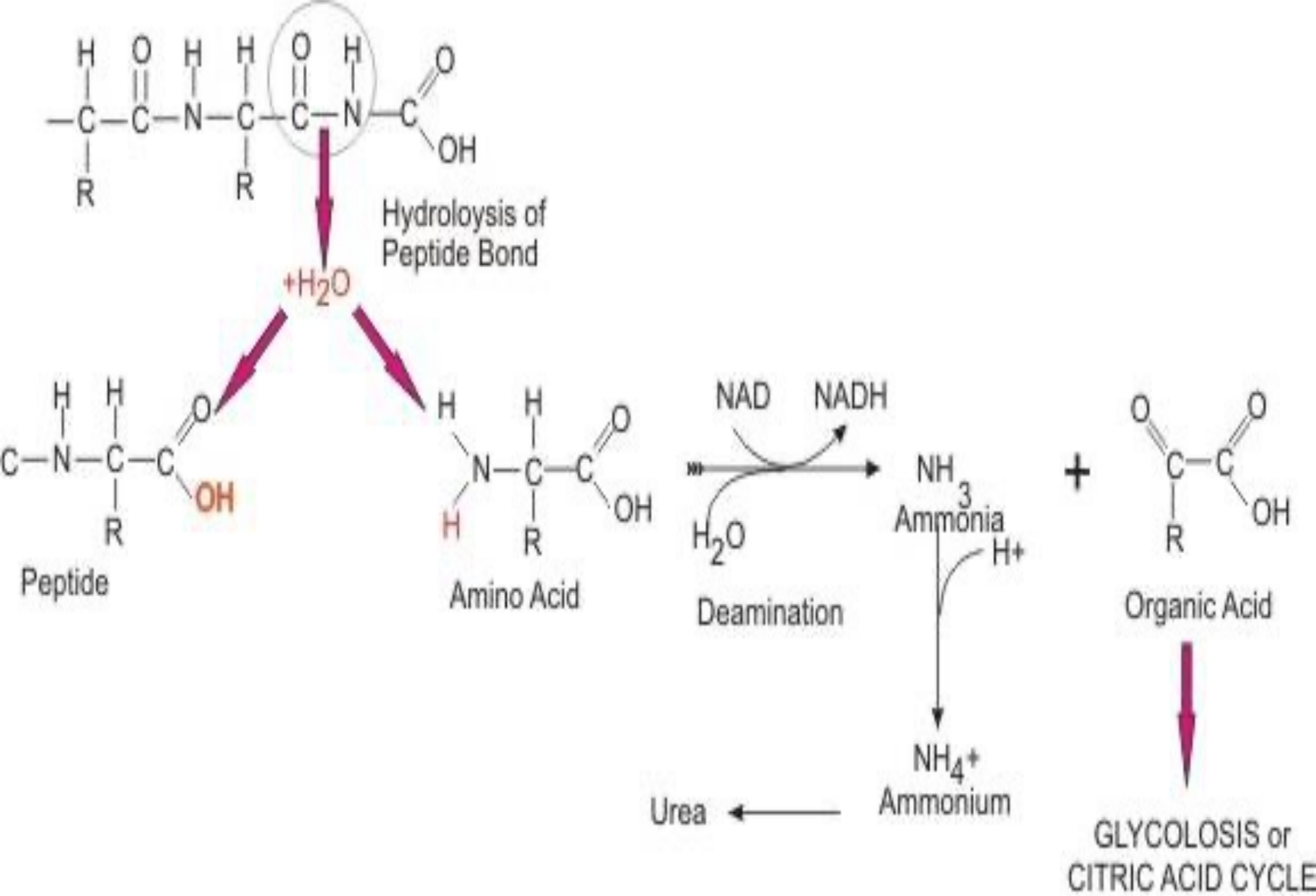
**NITRATES
(NO₃)**

**NITROBACTER
BACTERIA**

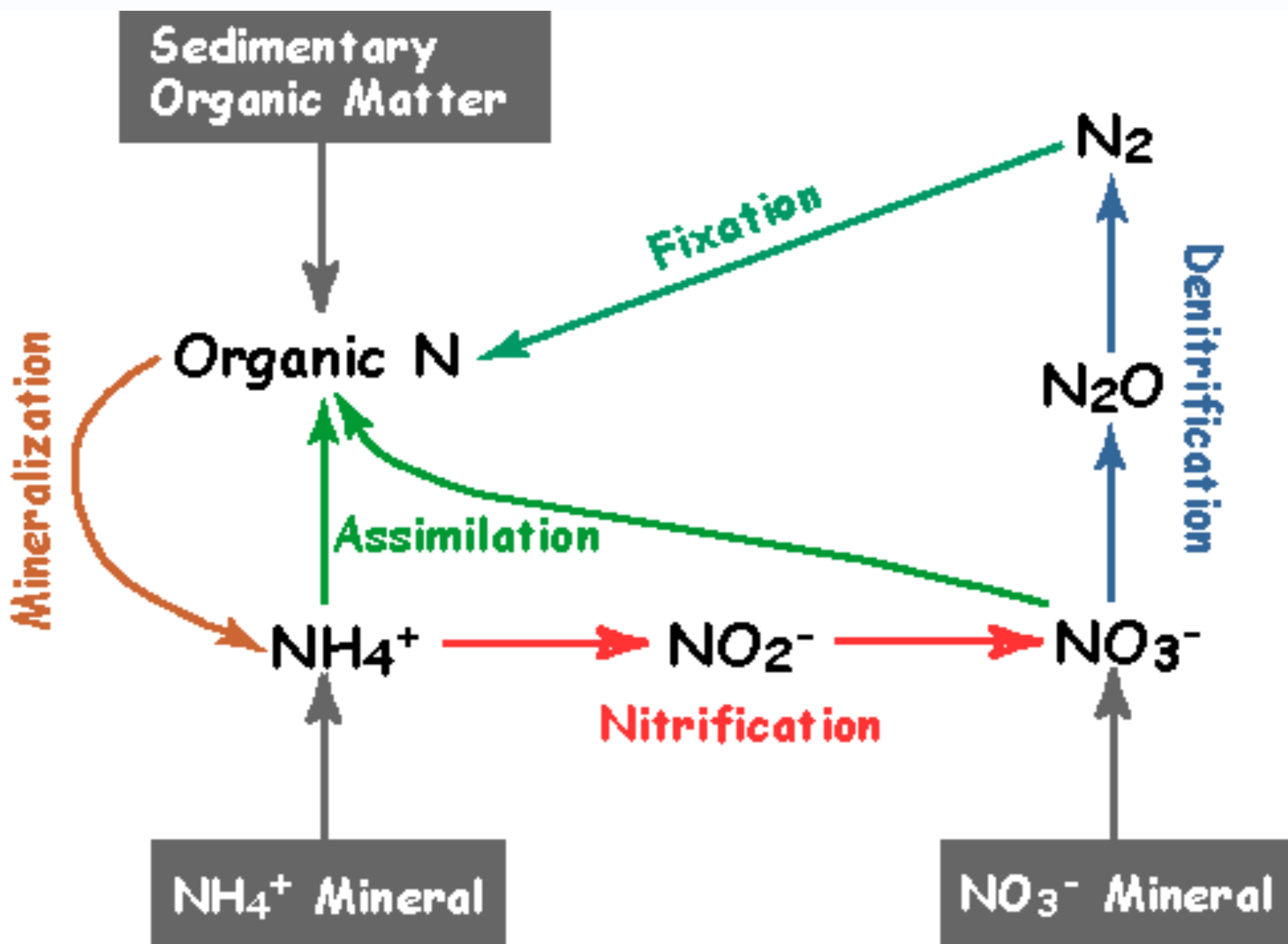


**NITRITES
(NO₂)**

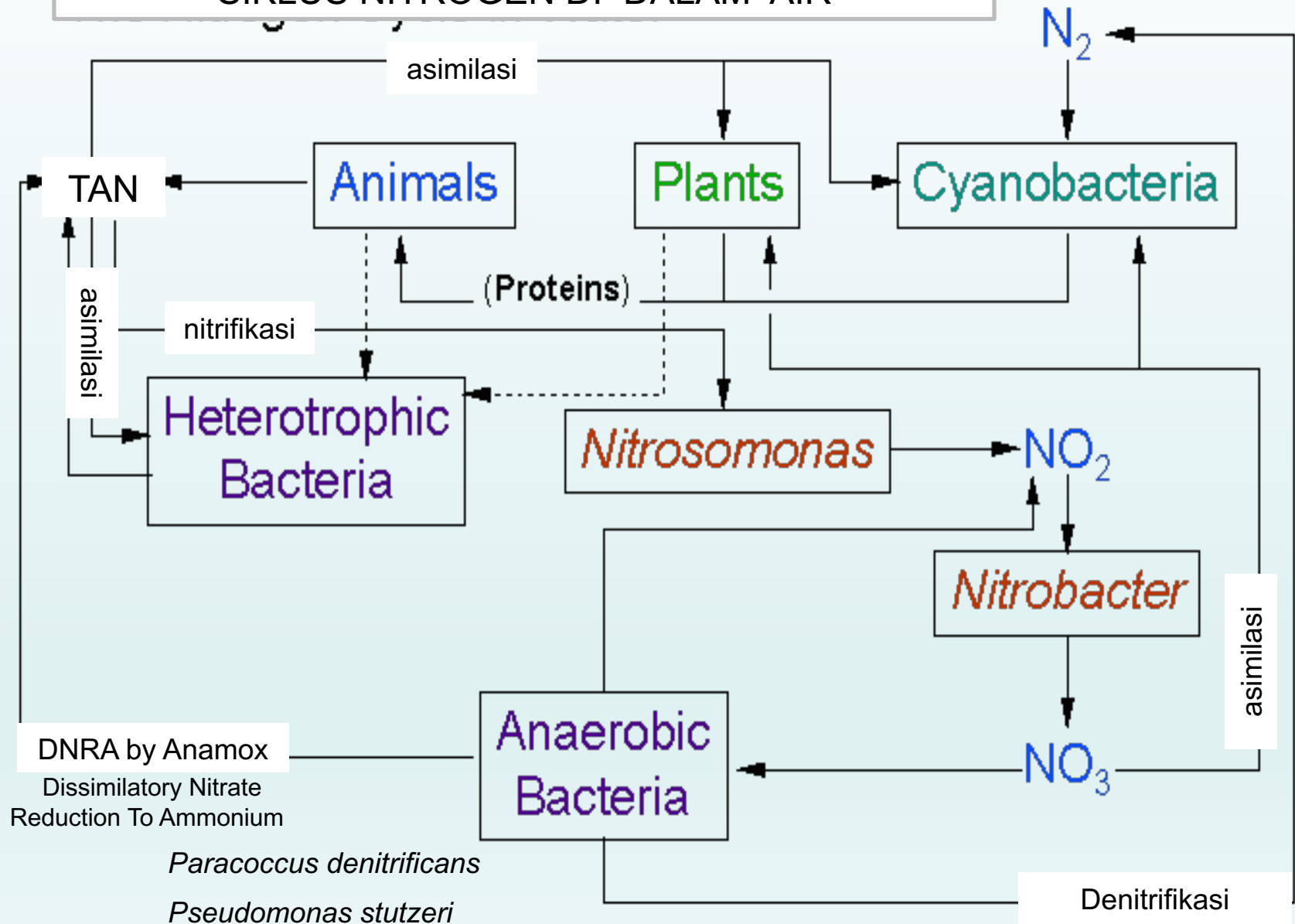




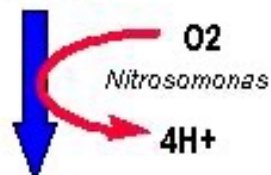
PROTEIN CATABOLISM



SIKLUS NITROGEN DI DALAM AIR

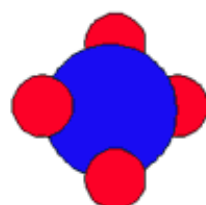


Organic N
(proteins
amino acids)



Ammonification

Nitrification

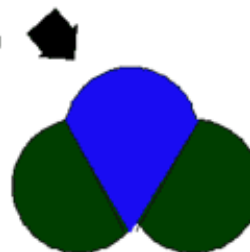


NH_4^+
Ammonium

+



Oxygen

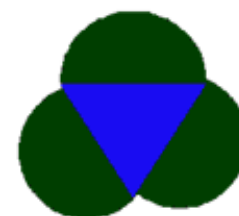


NO_2^-
Nitrite

+

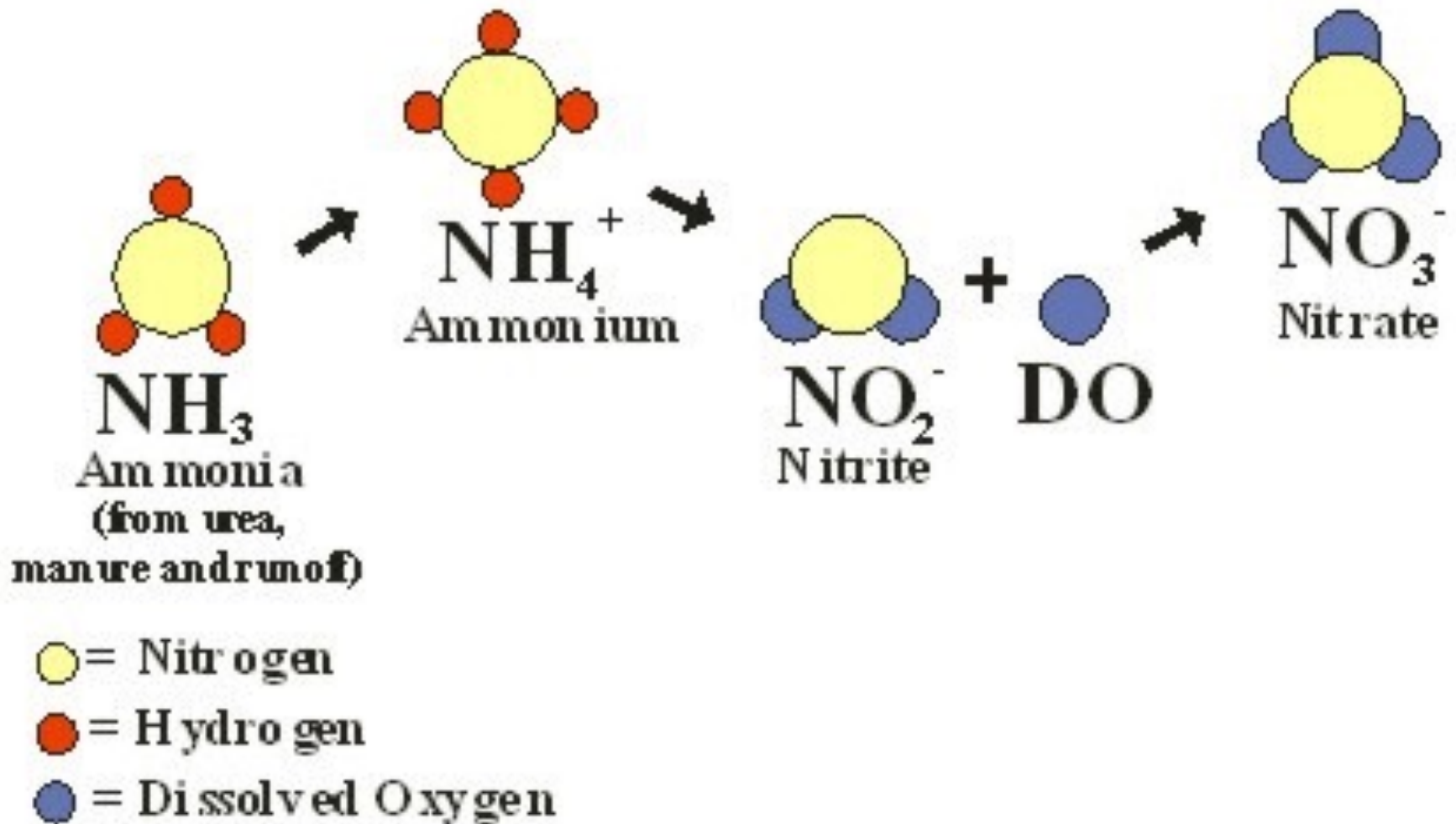


Oxygen

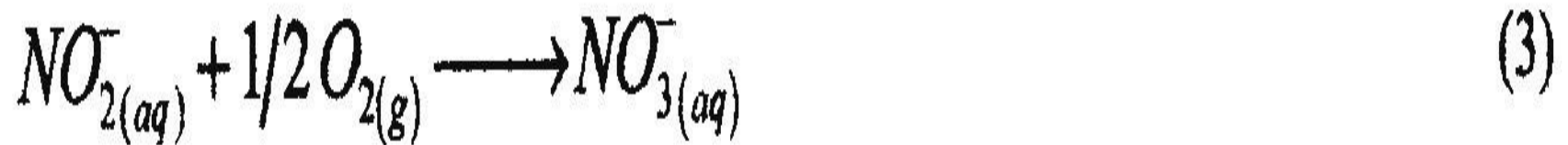
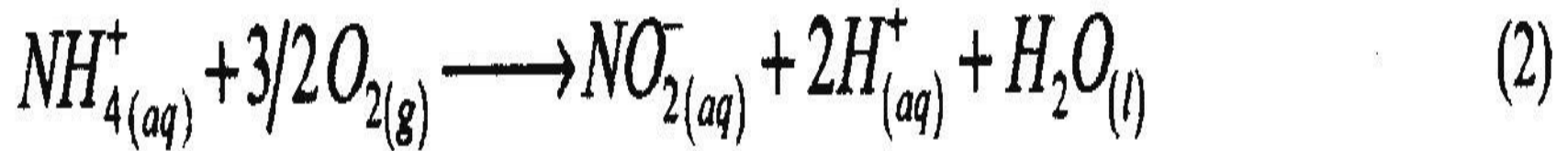


NO_3^-
Nitrate

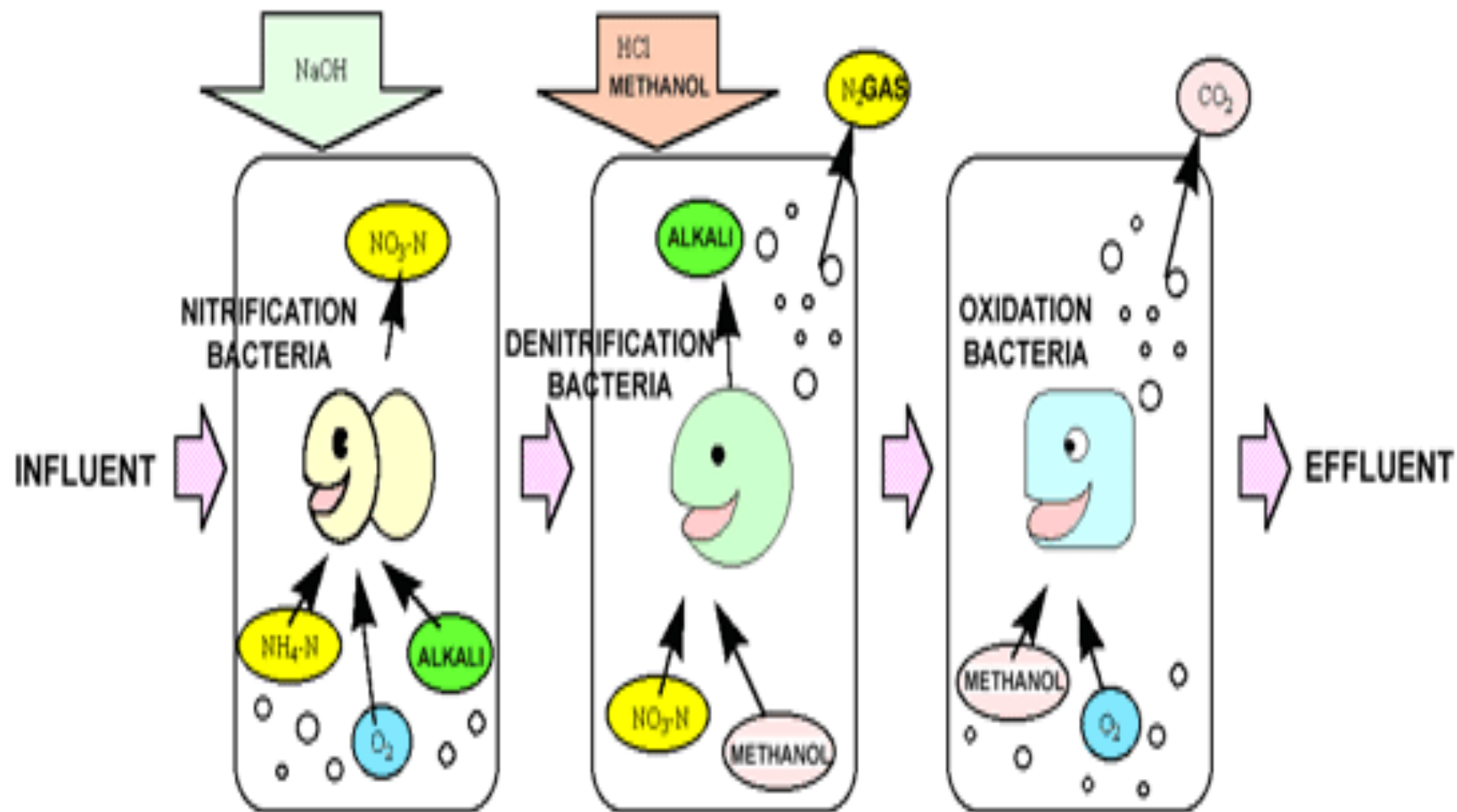
NITRIFIKASI



REAKSI DASAR NITRIFIKASI

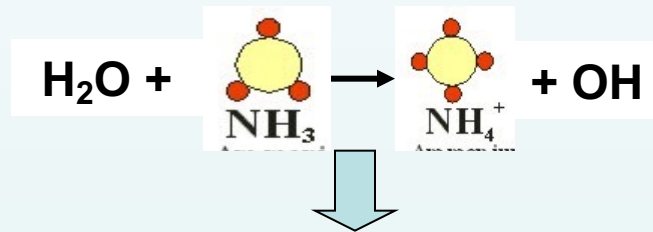


CONCEPT OF NITROGEN REMOVAL



MEKANISME KERACUNAN AMMONIA PADA IKAN

Reaksi kesetimbangan dalam darah :



dampaknya

Mengurangi kapasitas hamoglobin dalam mengangkut oksigen

Hypoxia sehingga mengakibatkan simptom otak

pH darah meningkat

Mengganggu reaksi katalis enzim dan stabilitas membran sel

PENGARUH AMMONIA TERHADAP IKAN NILA

Konsentrasi (mg/l NH ₃)	Growth	Lethal (LC ₅₀)	Sublethal	Sumber
0.43-0.53 0.035-0.092			Kronis Kronis	Kucuk (1999) Tran-Duy (2008)
2.4 2.88		24 jam 96 jam		Redner & Stickney (1979); Popma & Lovshin (1996) <i>dalam</i> Ridha & Cruz (2001)
0.27 1.81	No effect Reduce SGR			Hargreaves & Kucuk (2001)
0.14 0.35 0.71			Gill Liver Kidney	Benli, Koksai, Ozul (2008)
0.434 > 0.068	FCR increased PER decreased			El-Syafai (2004)
2 mg/l Nitrit 5 mg/l		Mati Mati		Colt (2001) Rakocy (2002)

Histopathologic analysis of Nile tilapia (*Oreochromis niloticus* L.) exposed to sublethal ammonia during six weeks

Tissue and histopathology	Ammonia concentrations (mg/l NH ₃)				
	Control	0.07	0.14	0.35	0.71
<i>Gills</i>					
Hyperemia	–	–	+	++	++
Chloride cell hyperplasia	–	–	+	++	+++
Fusion on the secondary lamella	–	–	–	–	++
Telangiectasis	–	–	–	+	+
<i>Liver</i>					
Cloudy swelling	–	–	+	++	+
Hydropic degeneration	–	–	–	++	+++
<i>Kidney</i>					
Hyperemia	–	–	–	+	++
Glomerulonephritis	–	–	–	++	++
<i>Muscle</i>	–	–	–	–	–
<i>Skin</i>	–	–	–	–	–

(–) No histopathology; (+) histopathology in <20% of fields; (++) histopathology in 20–60% of fields; (+++) histopathology in >60% of fields.

Sumber : Benli, Koksai, Ozul (2008)

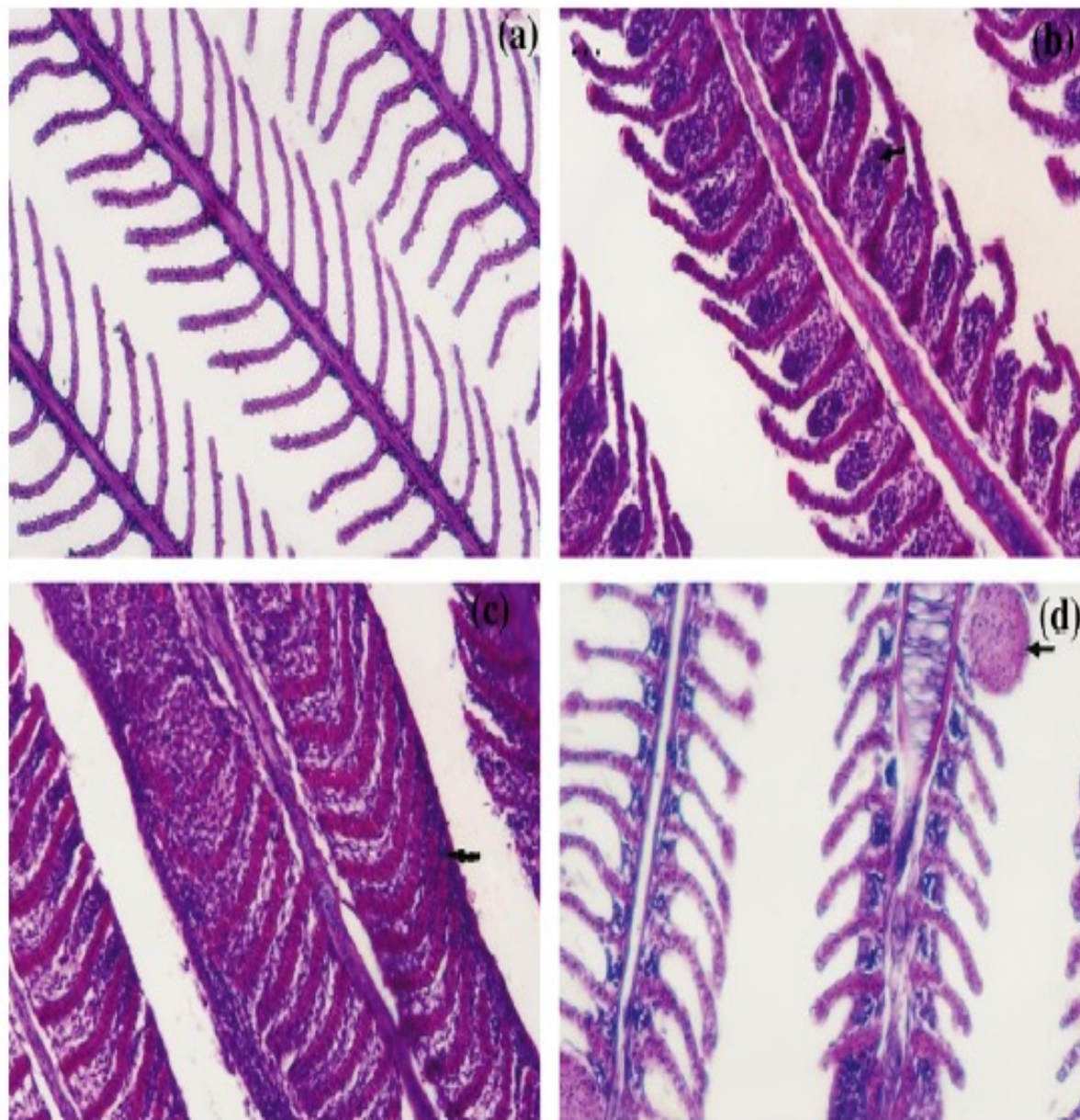
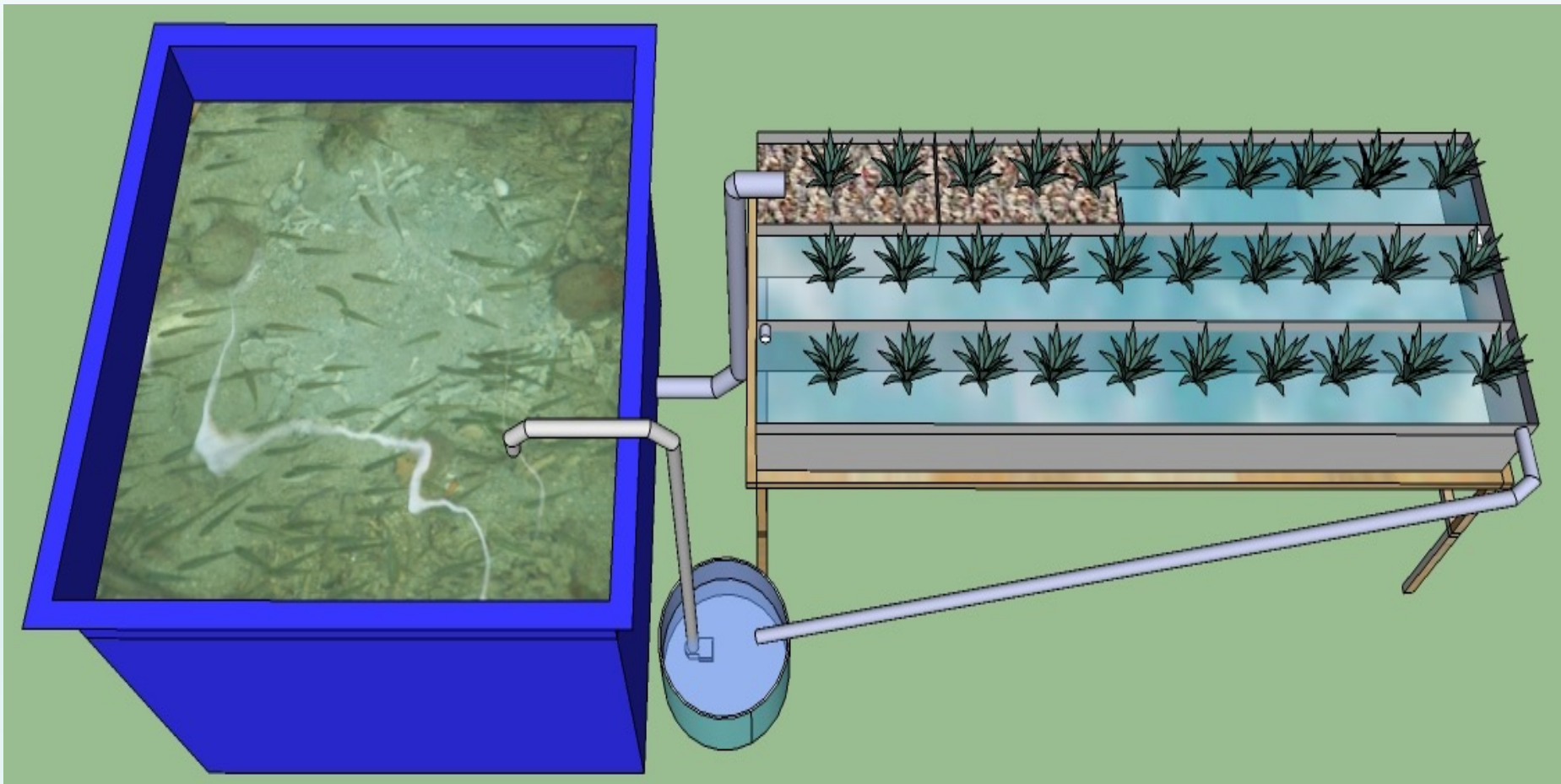


Fig. 1. Histological appearance of the gill tissue (a) control (H and E stain, 100 $\times$) (b) with chloride cell hyperplasia (arrow) after exposure to ammonia at 5 mg l⁻¹ concentration. (H and E stain, 100 $\times$) (c) with fusion (arrow) after exposure to ammonia at 10 mg l⁻¹ concentration. (H and E stain, 100 $\times$) (d) with telangiectasis (arrow) after exposure to ammonia at 10 mg l⁻¹ concentration. (H and E stain, 100 $\times$).

CONTOH OPTIMASI SISTEM AKUAKULTUR MELALUI REKAYASA PERAN SIKLUS NITROGEN

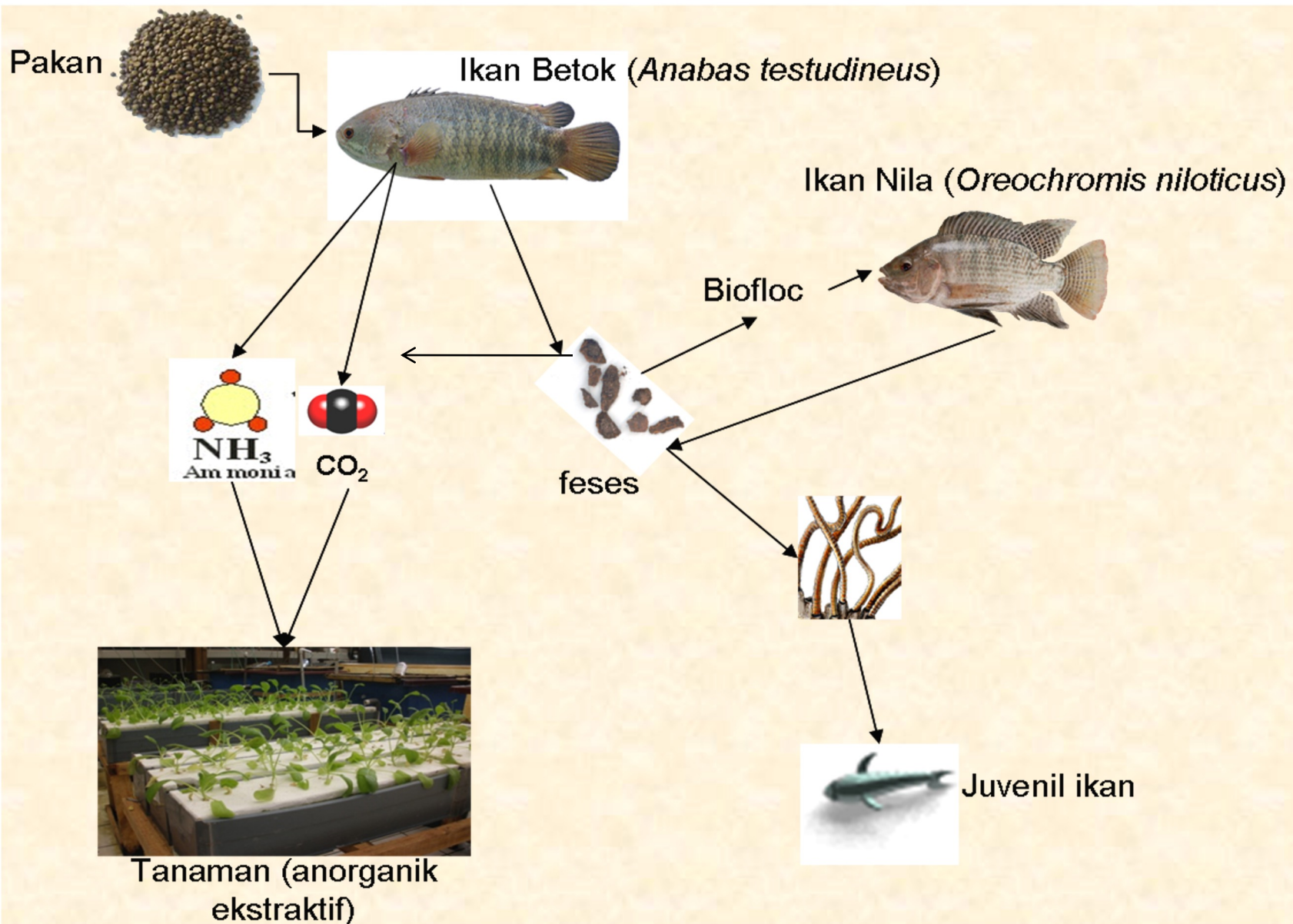
1. SISTEM AKUAPONIK



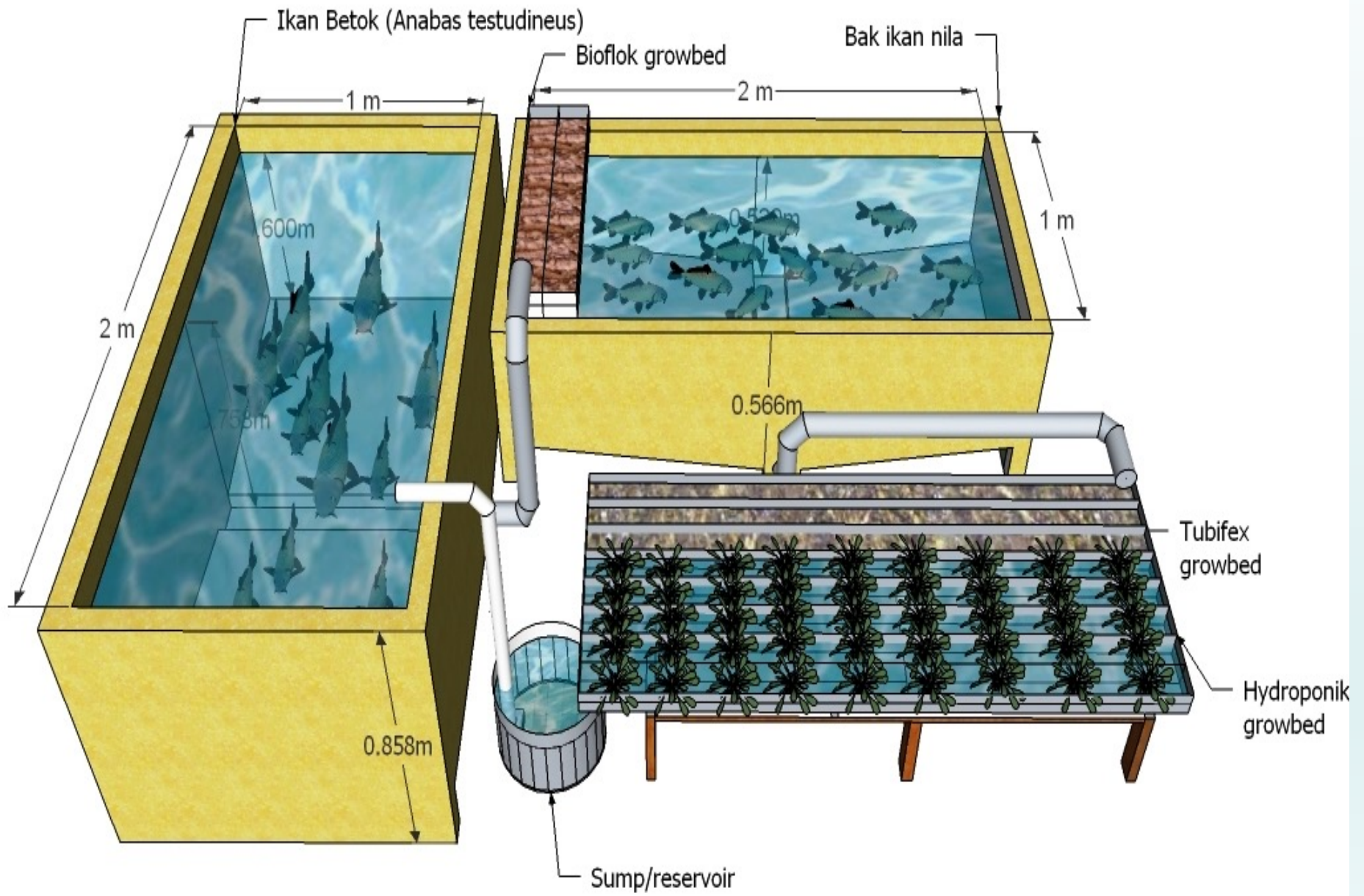
DEMPLOT SISTEM AKUAPONIK



ORGANISME DAN HIPOTESIS ALIRAN NUTRIEN



2. INTEGRATED MULTI TROPHIC AQUACULTURE SISTEM TERTUTUP (IMTA)



SKEMA INTEGRATED MULTI TROPHIC AQUACULTURE (IMTA) SISTEM TERBUKA

Integrated Multi-Trophic Aquaculture (IMTA)

Fed Aquaculture
(Finfish)

+

Extractive Aquaculture
Organic (Shellfish)
Inorganic (Seaweed)

