PENGIRAAN BEBAN PENCEMARAN
(POLLUTION LOAD CALCULATION)

PENDAHULUAN

Beban pencemaran air adalah kepekatan bahan cemar yang dibawa oleh jasad air pada sesuatu masa yang diberikan. Secara matematik, beban pada dasarnya adalah hasil daripada pelepasan air dan kepekatan bahan di dalam air.

Beban pencemaran air adalah penting untuk tujuan mengatur strategi dan merancang tindakan pencegahan dan mengawal pencemaran. Pelaksanaan kawalan beban pencemaran air adalah usaha untuk meningkatkan kualiti air sungai demi mengekalkan pelbagai kegunaan berfaedah sungai seperti sumber bekalan air, rekreasi, ternakair (akuakultur), pertanian serta menampung keperluan sistem ekologi.

INTRODUCTION

Water pollution load are the amount of polluting material that a water body is actually carrying at a given time. Mathematically, load is essentially the product of water discharge and the concentration of a substance in the water.

The pollution loads are useful in strategizing and planning the course of action for the prevention and control of pollution, so as to maintain the beneficial use of rivers as a source of water supply, recreation, aquaculture, agriculture as well as meeting the needs of ecological system.

BEBAN PENCEMARAN AIR

Pada tahun 2016, anggaran pengiraan beban pencemaran ditumpukan ke atas lima (5) jenis punca pencemaran air iaitu industri pembuatan, industri berasakan pertanian, loji rawatan kumbahan, ternakan babi dan pasar basah.

Sumber data industri pembuatan dan industri berasaskan pertanian diperolehi daripada JAS negeri manakala bagi loji rawatan kumbahan adalah daripada Indah Water Konsortium Sendirian Berhad. Data-data berkaitan aktiviti ternakan babi diperolehi daripada Jabatan Perkhidmatan Veterinar dan Pihak Berkuasa Tempatan membekalkan data bilangan pasar basah.

Pengiraan beban pencemaran di tumpukan kepada tiga (3) parameter utama yang memberikan kesan ketara kepada kualiti air sungai iaitu keperluan oksigen biokimia (BOD), pepejal terampai (SS) dan ammoniakal nitrogen (AN).

WATER POLLUTION LOAD

In the year of 2016, the estimation of pollution loads are focused on five (5) type of pollution such as manufacturing industries, agricultural industries, sewage treatment plant, piggery and wet market.

State DOE provide data on manufacturing industries and agricultural industries while sewage treatment plant were obtained from Indah Water Consortium Sendirian Berhad. Department of Veterinary Services provide piggery data and data on wet market were acquired from Local Authority.

Assessment on pollution load were focused on three (3) prime parameter that shows high impact to the water body namely biochemical oxygen demand (BOD), Suspended Solids (SS) and Ammoniacal Nitrogen (AN).

KEPERLUAN OKSIGEN BIOKIMIA

Pada tahun 2016, anggaran jumlah beban pencemaran BOD adalah sebanyak 540 tan/ hari. Pelepasan dari loji kumbahan adalah penghasil beban pencemaran BOD tertinggi iaitu sebanyak 266 tan/hari (49 %), diikuti aktiviti ternakan babi 209 tan/ hari (39 %), industri pembuatan 49 tan/ hari (9 %), industri berasaskan pertanian 10 tan/ hari (2%) dan pasar basah 6 tan/ hari (1%) ditunjukan seperti dalam **Rajah 6.1**

BIOCHEMICAL OXYGEN DEMAND

In year 2016, totalled of 540 tonnes/ day pollution load for BOD were estimate generated. Sewage remained the largest BOD loads generator with a total load of 266 tonnes/ day (49 %), followed by piggery which precipitating 209 tonnes/ day (39 %), while manufacturing industries contributed 49 tonnes/ day (9 %), agro-based industries 10 tonnes/ day (2 %) and wet markets 6 tonnes/ day (1 %), as shown in **Figure 6.1**.
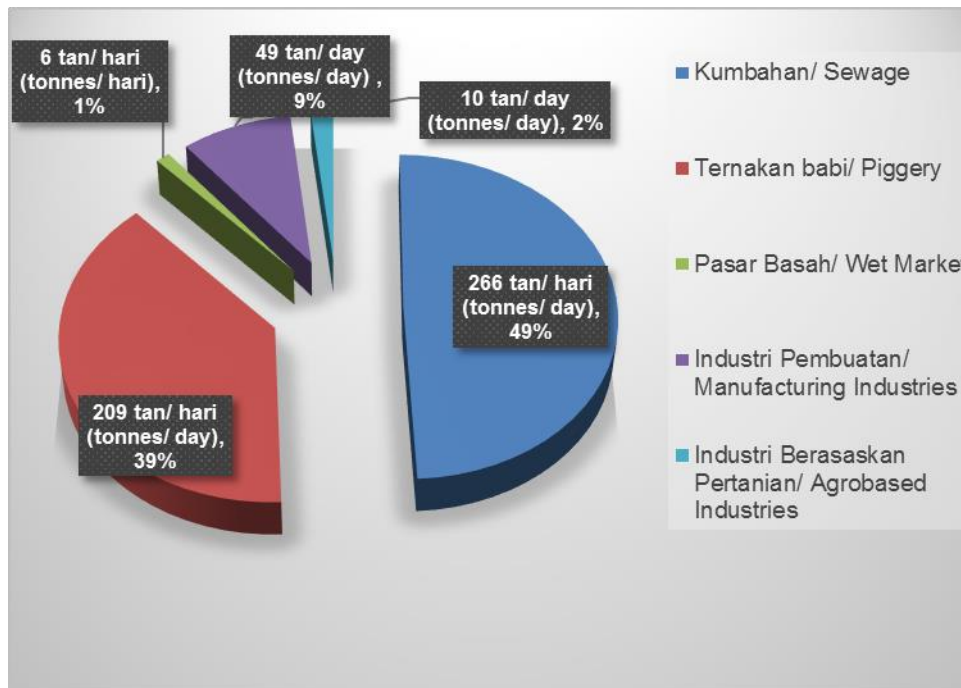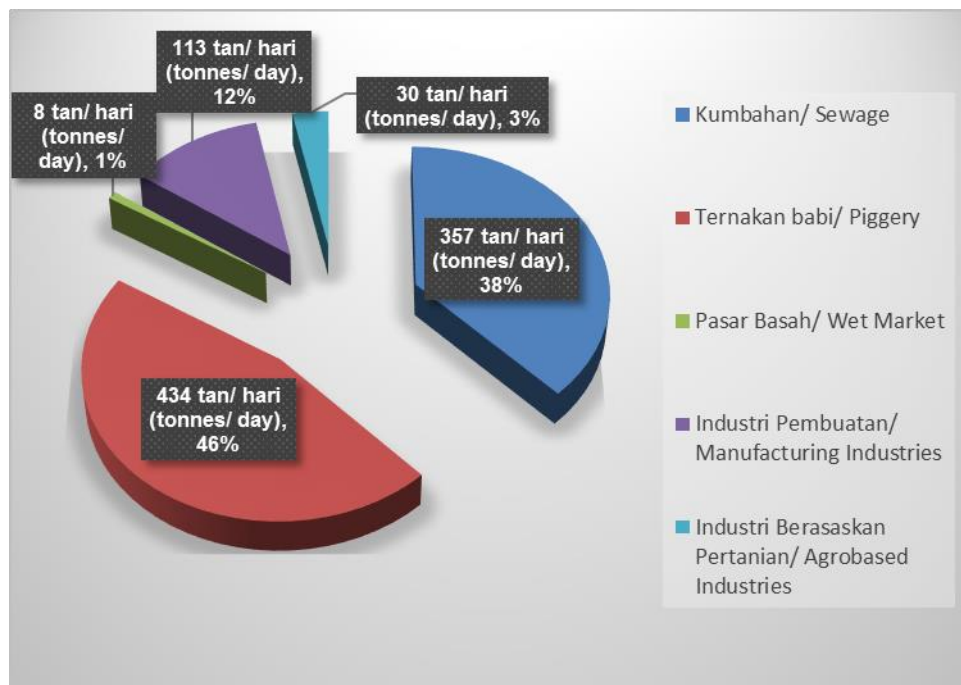

Rajah 6.1: Malaysia; Anggaran beban BOD mengikut punca pencemaran air, 2016
Figure 6.1: Malaysia; Assessment of BOD load by sources of water pollution, 2016

BEBAN PEPEJAL TERAMPAI

SUSPENDED SOLIDS LOAD

Pada tahun 2016, anggaran penghasilan beban pencemaran bagi SS adalah sebanyak 942 tan/ hari, di mana aktiviti ternakan babi kekal sebagai penghasil beban pepejal terampai utama dengan jumlah 434 tan/ hari (46 %), diikuti pelepasan daripada kumbahan sebanyak 357 tan/ hari (38 %), industri pembuatan 113 tan/ hari (12 %), industri berasaskan pertanian 30 tan/ hari (3 %), dan pasar basah 8 tan/ hari (1 %), seperti ditunjukkan dalam **Rajah 6.2**

In year 2016, estimation of summing-up the SS loads gave in a totalled of 942 tonnes/ day in which piggery remain largest contributor with a total load of 434 tonnes/ day (46 %), followed by sewage 357 tonnes/ day (38 %), manufacturing industries 113 tonnes/ day (12 %), agro-based industries 30 tonnes/ day (3 %) and wet market 8 tonnes/ day (1 %), as shown in **Figure 6.2**.
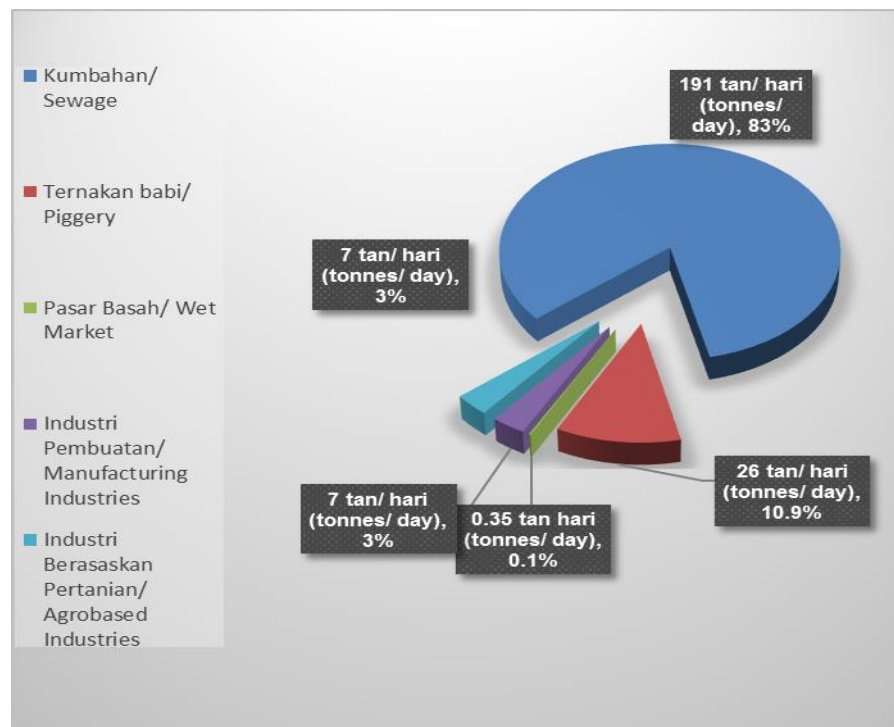

Rajah 6.2: Malaysia; Anggaran beban SS mengikut punca pencemaran air, 2016
Figure 6.2: Malaysia; Assessment of SS load by sources of water pollution, 2016

BEBAN AMMONIAKAL NITROGEN

AMMONIACAL NITROGEN LOAD

Pada tahun 2016, anggaran beban pencemar AN sebanyak 231.35 tan/ hari di mana pelepasan kumbahan adalah penghasil terbesar beban AN dengan jumlah sebanyak 191 tan/ hari (83 %), diikuti aktiviti dari ternakan babi iaitu 26 tan/ hari, industri pembuatan dan industri berasaskan pertanian masing mencatat jumlah sebanyak 7 tan/ hari (3 %), dan pasar basah 0.35 tan/ hari (0.1%), ditunjukan seperti dalam **Rajah 6.3.**

In year 2016, estimation of assessment on AN loads resulted a totalled of 231.35 tonnes/ day. Analysis showed sewage the largest AN loads with 191 tonnes/ day (83 %), followed by piggery activities 26 tonnes/ day, manufacturing industries and agro-based industries both generating 7 tonnes/ day (3 %), and wet market 0.35 tonnes/ day (0.1%), as shown in **Figure 6.3**.
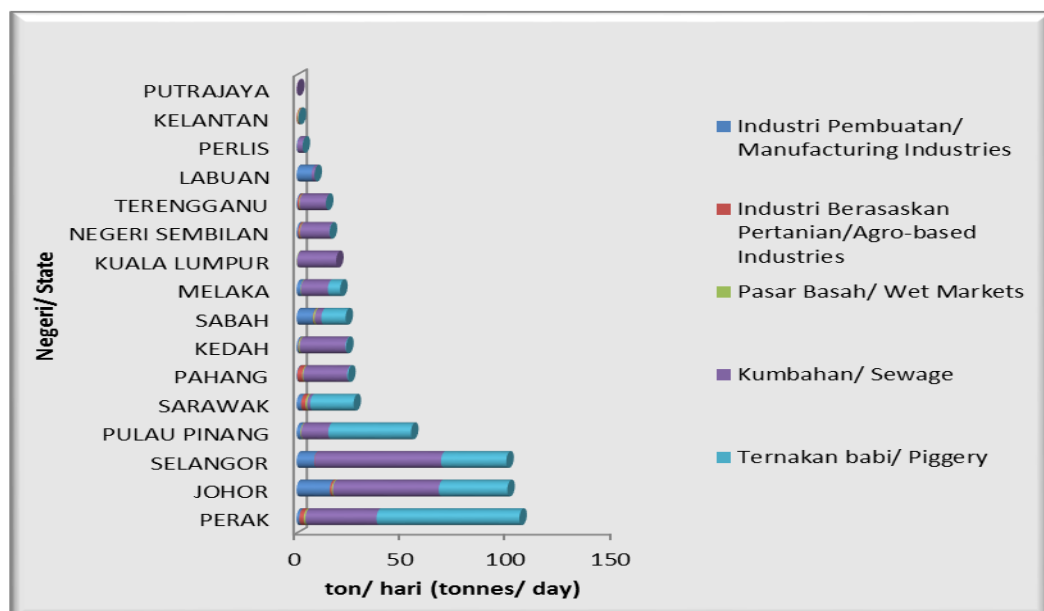

Rajah 6.3: Malaysia; Anggaran beban AN mengikut punca pencemaran air, 2016
Figure 6.3: Malaysia; Assessment of AN load by sources of water pollution, 2016

BEBAN PENCEMARAN KEPERLUAN OKSIGEN BIOKIMIA (BOD) MENGIKUT NEGERI

Anggaran pengiraan beban BOD di negeri Perak adalah tertinggi iaitu sebanyak 106 tan/ hari, diikuti negeri Johor 100 tan/ hari, negeri Selangor 99 tan/ hari, Pulau Pinang 54 tan/ hari dan negeri Sarawak menjana sebanyak 27 tan/ hari. Beban BOD untuk sebelas (11) negeri termasuk Wilayah Persekutuan Labuan dan Putrajaya adalah kurang dari 24 tan/ hari. Senarai beban pencemar BOD mengikut negeri ditunjukkan seperti di **Rajah 6.4.**

BIOCHEMICAL OXYGEN DEMAND LOAD (BOD) IN ACCORDANCE WITH STATES

Estimation of BOD *loads generated in the state of Perak recorded the highest value with 106 tonnes/ day, followed by state of Johore 100 tonnes/ day, state of Selangor 99 tonnes/ day, state of Penang 54 tonnes/ day and state of Sarawak was generating 27 tonnes/ day. Others eleven (11) states including federal Territory of Labuan and Putrajaya generated less than 24 tonnes/ day, as shown in* **Figure 6.4***.*
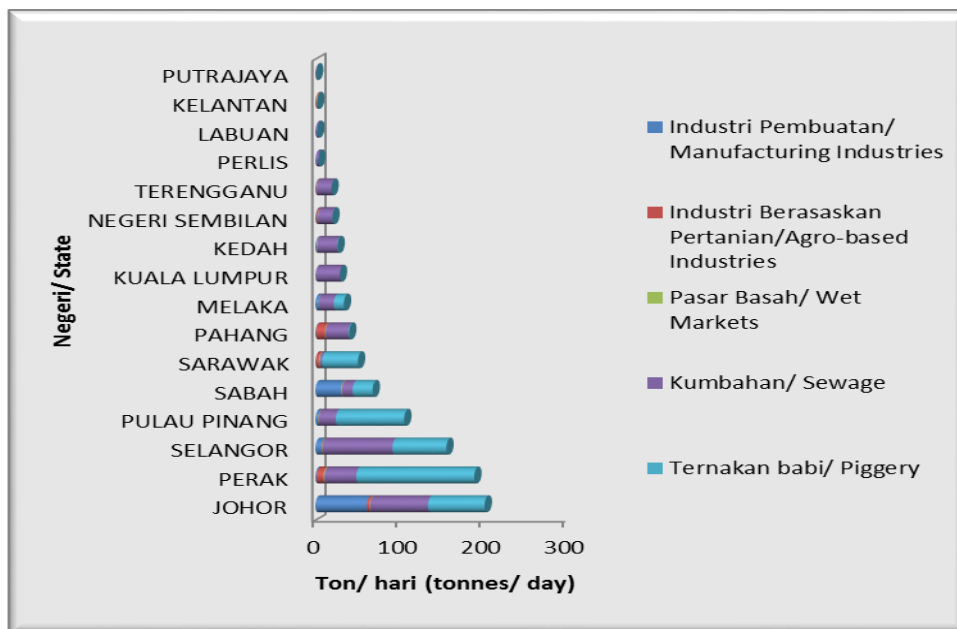

Rajah 6.4: Malaysia; Taburan anggaran beban BOD dan punca pencemaran air mengikut negeri, 2016
Figure 6.4: Malaysia; Dispersions of BOD load assessment and sources of water pollution by states, 2016

BEBAN PENCEMARAN PEPEJAL TERAMPAI MENGIKUT NEGERI

SUSPENDED SOLID LOAD IN ACCORDANCE WITH STATE

Anggaran penjanaan beban pepejal terampai di negeri Johor di dapati tertinggi dengan jumlah 202 tan/ hari, diikuti negeri Perak 189 tan/ hari, negeri Selangor 156 tan/ hari, Pulau Pinang 106 tan/ hari dan Sabah 62 tan/ hari. Lain-lain negeri didapati menghasilkan kurang daripada 51 tan/ hari ditunjukkan di dalam **Rajah 6.5**.

Estimation of suspended solids loads generated in the state of Johor recorded the highest value with 202 tonnes/ day, followed by state of Perak 189 tonnes/ day, state of Selangor 156 tonnes/ day, state of Penang 106 tonnes/ day and Sabah state 62 tonnes/ day. Other states generated less than 51 tonnes/ day, as shown in Figure 6.5
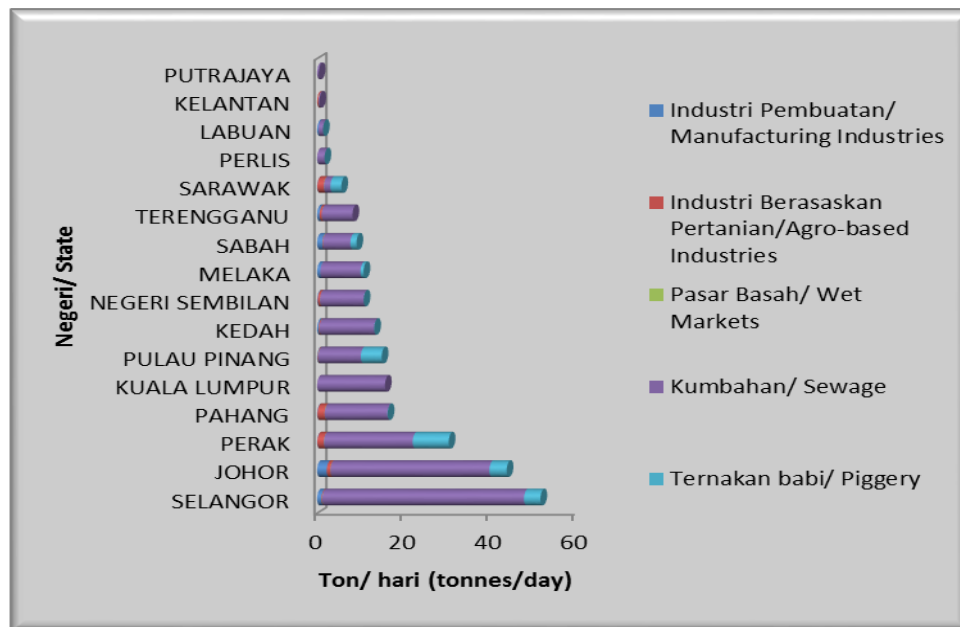

Rajah 6.5: Malaysia; Taburan anggaran beban SS dan punca pencemaran air mengikut negeri, 2016
Figure 6.5: Malaysia; Dispersions of SS load assessment and sources of water pollution by states, 2016

BEBAN PENCEMARAN AMMONIAKAL NITROGEN MENGIKUT NEGERI

Anggaran pengiraan beban AN di negeri Selangor adalah tertinggi dengan jumlah 52 tan/ hari, diikuti negeri Johor 44 tan/ hari, negeri Perak 30 tan/ hari manakala negeri Pahang dan Wilayah Persekutuan Kuala Lumpur masing-masing mencatat jumlah beban sebanyak 16 tan/ hari. Lain lain negeri didapati menyumbangkan kurang dari 15 tan/hari, ditunjukkan sepertimana dalam **Rajah 6.6**.

AMMONIACAL NITROGEN LOAD IN ACCORDANCE WITH STATE

52 tonnes/day of ammoniacal nitrogen (AN) loads was estimate generated by state of Selangor , followed by states of Johor 44 tonnes/ day, state of Perak 30 tonnes/ day while state of Pahang and federal Territory of Kuala Lumpur both generated 16 tonnes/ day. Other states showed to generate less than 15 tonnes/ day, as shown in **Figure 6.6.**

Rajah 6.6: Malaysia; Taburan anggaran beban AN dan punca pencemaran air mengikut negeri, 2016
Figure 6.6: Malaysia; Dispersions of AN load assessment and sources of water pollution by states, 2016