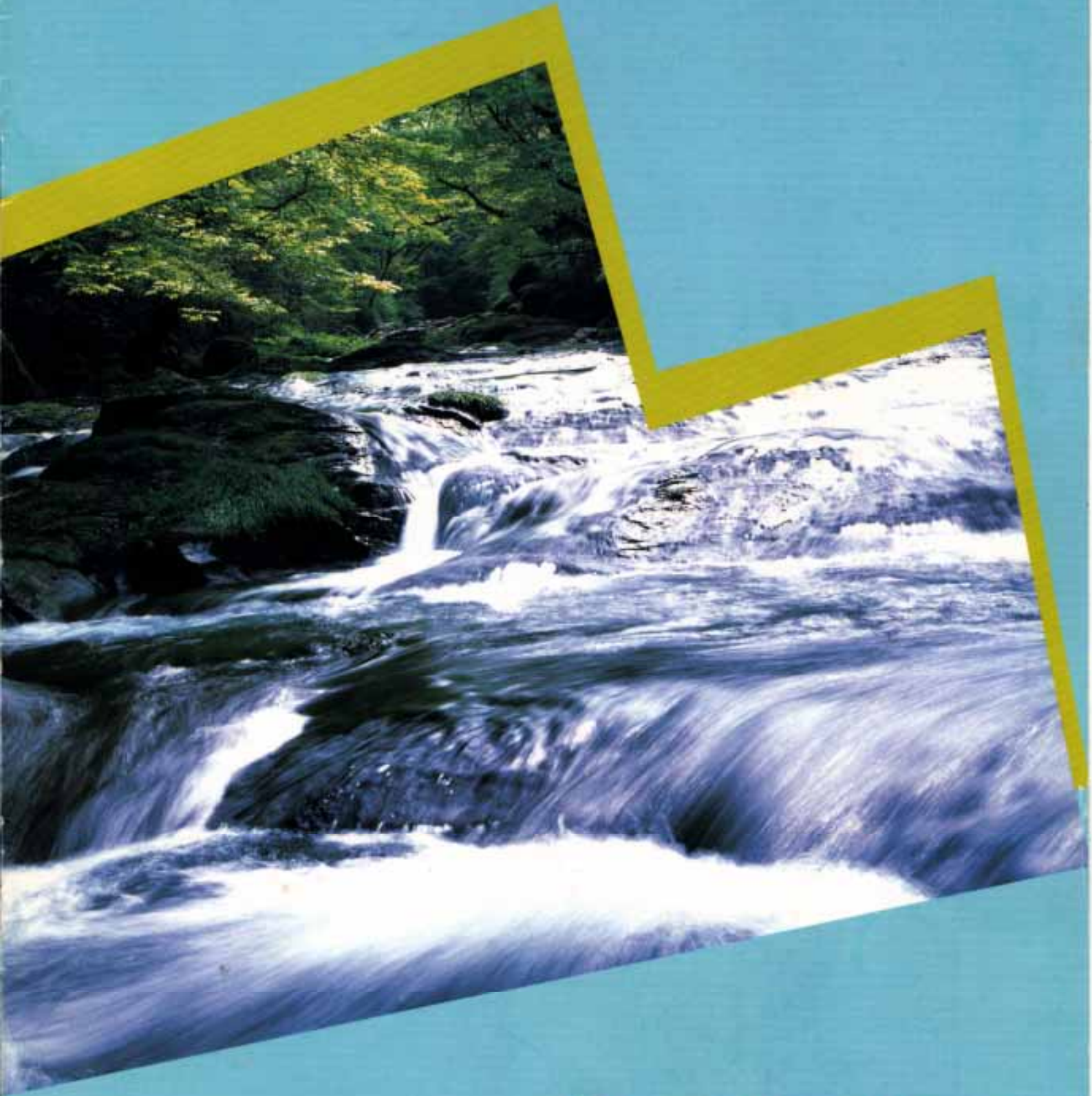



# ANTHRACITE FILTER MEDIA



 **TOHKEMY CORPORATION**

## How to use...

- 1) Anthracite, which is light-weight filter medium, can be backwashed by small amount of water, but it may run away with water flow by too high backwash L.V., on the other side. Therefore, set appropriate backwash rate according to its effective size.
- 2) Anthracite layer should be made thicker than sand layer. Sand is used for surface filter but anthracite has high void percentage and turbidity is caught at fairly deep part of it. Accordingly, the impurity capturing rate of anthracite is high. However, on the other hand, suspended solids captured at the depth may leak suddenly when pressure is applied. Be sure to make the filtration layer thick and carry out periodical backwash without fail.
- 3) In order to the capture turbidity at up to the depth, carry out washing uniformly by performing surface washing as well as sufficiently developing backwash up to the lower part of filtration layer.
- 4) Since anthracite, which has about 2 times large effective size of sand, has the same backwash expansion rate as that of sand, build such a filter bed composed of multi-media layers where anthracite of twice large effective size of sand is placed on the sand. It is also possible to build up a dual-media filter bed of reverse effective size arrangement where coarse suspended solids are captured at the upper anthracite layer and fine suspended solids are captured at the lower sand layer, and moreover a tri-media filter bed where garnet layer having 1/2 effective size of sand is placed under the above-mentioned dual-media. In these filtrations, it will bring its ability of depth filtration effect into full play that anthracite layer has about 2 times height of sand layer.
- 5) In the case of multi-media filtration, fine and viscous impurities containing comparatively heavy

suspended solids may be caught between the anthracite layer and sand layer, resulting in a sandwich state. To prevent this, it is necessary to design the multi-media filtration system elaborately for enabling sufficient wash, by combining air scouring, surface washing and backwashing, etc.

- 6) In the case of anthracite and filter sand of comparatively small effective size, backwashing by combination of water and air may make anthracite flow away. To prevent this, it is necessary to adjust the air amount and water amount appropriately.

As the standard of living elevates, water of high purity and rich volume of water are more needed, it is therefore estimated that 10 years hence, a shortage of water will be confronted inevitably.

For this solution, water treatment technique will be developed and it seems that filtration technique will find a way out, where solid structure will be applied due to shortage of land, toward compact and speedy filtration.

On the other hand, we suppose that, in the field of wastewater and sewage treatment, technique for final treatment will have been developed so as to further prevent river, lake and ocean pollution. And that recycled water works as treatment of used industrial water and living water due to shortage of water, and filtration technique will further advance, and rapid filtration of solid type will be developed.

Anthracite, featuring favorable specific gravity, and great filtering capacity in deep layer thanks to large percentage of void and material good for filter medium, will go a long way toward developing new filtration technique.



#### (4) Back wash development rate

Below are given the test results of anthracite and filter sand on back wash development rate. (column  $\phi 200 \times 1500\text{mm}$ )

##### Anthracite

Symbol	A	B	C	D	E	F	G	H	I
Effective size (mm)	0.5	0.6	0.9	1.0	1.2	1.5	2	3	4
Coefficient of uniformity	1.5	1.7	1.4	1.4	1.4	1.4	1.4	1.4	1.4

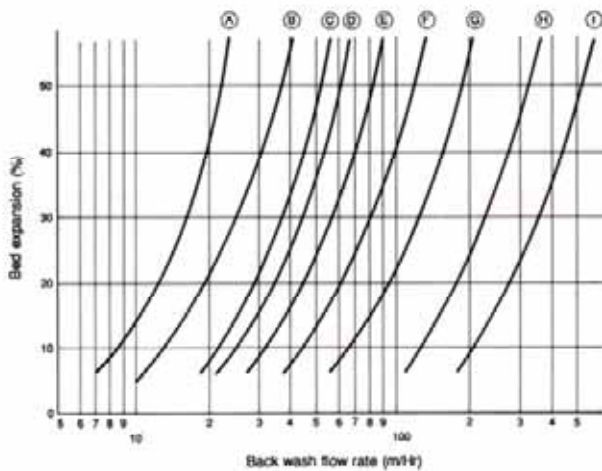


Fig. 1: Back wash and bed expansion

(Single layer)  
Back wash flow rate and back wash bed expansion of anthracite with water at temperature of  $15^\circ\text{C}$ .



##### Filter sand

Symbol	①	②	③	④	⑤	⑥	⑦
Effective size (mm)	0.45	0.5	0.6	0.8	1.0	1.4	1.8
Coefficient of uniformity	1.5	1.5	1.5	1.5	1.5	1.5	1.5

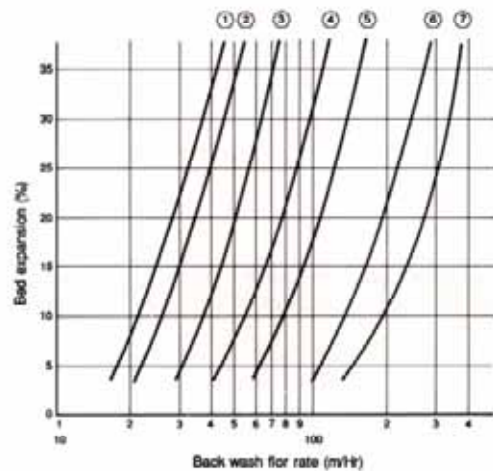


Fig. 2: Back wash and bed expansion

Back wash flow rate and back wash bed expansion of filter sand with water at temperature of  $15^\circ\text{C}$ .

On the other hand, expansion can be calculated by making use of the equations of expansion coefficient of sand and anthracite filter medium established by Mr. Shinohara.\*

$$(1) V = 0.139ds^{3/2} (1+0.06es) (9t+310) es^{2/3} \quad (\text{filter sand});$$

$$(2) V = 0.045da^{3/2} (1+0.06ea) (9t+310) ea^{2/3} \quad (\text{anthracite});$$

where

V: Back wash flow rate (cm/min)

da: Effective size of anthracite filter medium [mm];

ds: Effective size of sand filter medium [mm];

ca: Uniformity coefficient of anthracite filter medium;

cs: Uniformity coefficient of sand filter medium;

ea: Expansion coefficient of anthracite filter medium [%];

es: Expansion coefficient of sand filter medium [%];

t: Water temperature [ $^\circ\text{C}$ ]

\* SHINOHARA, WATER PROCESS TECHNIQUE  
Vol. 6 No. 9 1965

# Tohkemy's Anthracite Filter Media

## First-class quality

Tohkemy Corporation, formerly Toyo Rozai Kogyo Co., Ltd. have been manufacturing Anthracite Filter Media for about 30 years, supplying the products everywhere in Japan as well as exporting them to Korea, Taiwan, Hong Kong, China, Singapore, Indonesia, Malaysia, Thailand, India, Saudi Arabia, Iran, etc. around the world.

We, leading maker of Anthracite Filter Media, have established severe acceptance quality standards on raw anthracite and use raw material of first-class quality. Since we select non-flat crushed anthracite and, as for sieving, we make accurate grading of grains by the use of very accurate sieving equipment, we believe that the quality of our products is excellent.

Since we started in manufacture, we have made far and wide research for the materials and have used raw materials from various places in the world. Now, we have found Hon Gay Coal is durable and stable materials as well as reliable resources.

## Our Factories

In 1993, cooperating with Duong Nhat Investment Co., Ltd., we have completed construction of our manufacturing plant for Anthracite Filter Media near Hon Gai Coal Mining Site in Vietnam.

We are now ready to export all over the world. Anthracite Filter Media of best quality, at a reasonable price, inspected severely in accordance with your specific demands. And also, ready to deliver from two manufactures in East Japan and West Japan. Anthracite Filter Media is an article of which percentage of freight is high and we always ask users to bear the freight. Domestically we have one factory in Osaka city and another in Sodegaura costal industrial region, Chiba Pref., and complete arrangements to deliver the products from one of the factories located near users. We have settled our best service arrangements so as to lessen freight and shorten delivery time.

In the case of exportation, the products can be conveniently shipped from Vietnam, Yokohama and Kobe port.

## Quality of Tohkemy's Anthracite Filter Media

### (1) Material standards (as per coal analysis of JIS)

Item	Quality standard (Wt %)	Tohkemy product (Sample No. 1)	Tohkemy product (Sample No. 2)
Fixed carbon	Not less than 80%	89.41%	87.8%
Ash	Not more than 10%	3.02%	4.07%
Volatile matter	Not more than 10%	6.55%	6.7%
Constant moisture	Not more than 3%	1.02%	1.43%
Sulfur content	Not more than 1.0%	0.48%	0.5%

The percentage of fixed carbon indicates purity of anthracite. The larger the percentage becomes, the larger the resistance to chemicals (hydrochloric and solubility) and physical strength (wear ratio) become. Percentage of ash indicates impurity of

anthracite, i.e. degree of mixed soil content in the process of coal formation, accordingly crack tends to be caused in the part mixed by ash. When percentage of mixture is more than 10%, the physical strength and chemical resistance become inferior.

### (2) Quality standard as filter medium

Item	Quality Standard	Tohkemy Product (Sample No. 1)	Tohkemy Product (Sample No. 2)
True sp. gr.	1.40 ~ 1.60	1.46	1.45
Apparent sp. gr.	0.65 ~ 0.75	0.73	0.71
Void percent	Not less than 50%	52.60%	53.00%
Ignition loss	Not less than 87%	95.18%	92.76%
Friability	Not more than 3%	1.56%	1.28%
Hydrochloric acid solubility	Not more than 6.0%	1.92%	0.89%

In the case of using anthracite, the washing turbidity has exceedingly high value, compared with standard for filter sand of 30 degrees, because anthracite is not washed with water. However, since anthracite, unlike filter sand, is not clayey, but powdered carbon remains in some quantities after being sieved with highly accurate sieving machine, such powdered carbon can be easily removed by back wash at early stage.

### (3) Standard grain sizes of TOHKEMY's anthracite

#### Grade A

	712	816	1018	1220	1530	24	2550	36	48
Effective size (mm)	0.65±0.05	0.83±0.05	1.05±0.05	1.25±0.05	1.55±0.08	2.15±0.10	2.55±0.10	3.20±0.20	4.30±0.20
Uniformity coefficient	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Max. size	1.3	1.6	2.1	2.2	3.2	4.3	5.3	6.3	8.4
Min. size	0.4	0.45	0.5	0.6	0.8	1.0	1.3	1.5	2.0

#### Grade S

	710	813	1017	1219	1525	23	2540	35	47
Effective size (mm)	0.65±0.03	0.83±0.03	1.05±0.03	1.25±0.05	1.55±0.08	2.15±0.10	2.55±0.10	3.20±0.20	4.30±0.20
Uniformity coefficient	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
Max. size	1.1	1.4	2.0	2.1	2.8	3.3	4.4	5.5	7.7
Min. size	0.41	0.45	0.53	0.63	0.84	0.9	1.25	1.40	1.90

The above are standard grain sizes of our products. We complete arrangements for speedy and instant delivery. At your request, we can deliver anthracite of other effective sizes and coefficient of uniformity.

# Features of Anthracite



# 1

## Catching turbidity at external void

Anthracite is not a filter medium like activated carbon which absorbs substances dissolved in water at grain internal void to remove it, but a filter medium which catches at grain's external void suspended solids (insoluble substances) changed from dissolved substances by pretreatment such as dosing.

Sufficient back wash permits semi-permanent use to the filter medium.

# 2

## Catching a large quantity of turbidity

Since sand has an uniform grain shape and its weight is rather large, filter layer become tight and percentage of void becomes less. Therefore turbidity can not be caught in large quantities. On the other hand, since anthracite has crushed form and grains are all different from each other, percentage of void becomes large, and therefore turbidity can be caught in large quantities.

# 4

## Easy back wash

Since anthracite is a light filter medium, back wash can be easily made. Furthermore, since the surface of filter medium grain is smooth, turbidity caught can be easily removed and efficiency of washing is high.

(The volume of water for back wash is small and time required is short.)

# 3

## Filtration up to deep layer

Since shape of grains is quite irregular and grains are all different from each other, and due to light mass, filter layer does not easily become tight, so filtration can be performed in deeper layer, not only at the surface part of layer. Accordingly loss of head ( $\Delta P$ ) is rather small and the number of times of washing can be reduced.

# 5

## High resistance to chemicals

Since anthracite of good quality has only few impurity and a high carbon content, such anthracite is dissolved neither in acid water nor alkaline water and, therefore, most suitable for filter medium. Anthracite is widely used in the chemical industry such as filtration of brine used in soda makers, etc.

## Outline

From the fact that  $H_2O$  is an essential constituent occupying nearly 80% of human body and that ancient civilization developed on the banks of large rivers having rich volume of water such as the rivers Euphrates and Tigris, the Hwang Ho (Yellow River) etc., there is no room for doubt that water is indispensable for human life and prosperity.

Nevertheless water and air have been ignored as valueless. Recently the concentration of population to cities and the elevation in the standard of living have been expediting the development of water supply and drainage works. On the other hand, as industry advances, environmental pollution caused by industrial wastewater has become an object of public concern, and consequently wastewater treatment technique has highly developed and filtration technique and filter media have been newly advanced.

Formerly sand was used as filter medium and recently anthracite has been fitted for use instead of sand or together with sand by making use of its various characteristic features.

Anthracite is most highly carbonized of all the types of coal, and has the highest carbon content and very low volatile matter, compared with other types of coal such as bituminous, lignite, brown coal, etc.

Anthracite having a large percentage of carbon (fixed carbon) and a low ash content is judged as of good quality.

Carbon is largely resistant to water and chemicals among other substances and also, coal of high purity and of good crystalline condition has the highest physical strength, e.g. like diamond composed of carbon. Making use of these characteristics, Anthracite has been developed as filter medium.



Hon Gai Factory