# Indian Minerals Yearbook 2016

**(Part- III : Mineral Reviews)**

## 55th Edition

# POTASH

## (FINAL RELEASE)

**GOVERNMENT OF INDIA**
**MINISTRY OF MINES**
**INDIAN BUREAU OF MINES**

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

**February, 2018**

# 40 Potash

Potash is the common term for nutrient form of the element potassium (K). Potassium occurs abundantly in nature. All commercial potash deposits come originally from evaporite deposits and are often buried deep below the earth's surface. Potash ores are typically rich in Potassium Chloride (KCl) and Sodium Chloride (NaCl) and are generally obtained by conventional underground mining, with the extracted ore ground into a powder. Other method includes in situ solution mining of underground potash strata followed by solar evaporation in surface pond and evaporation methods from brines. Potassium is the third major plant and crop nutrient after nitrogen and phosphorus. There are four common kinds of straight potash fertlizer - Muriate of Potash (MOP), Sulphate of Potash (SOP), Potassium Magnesium Sulphate and Potassium Nitrate.

The principal ore is sylvinite, a mixture of sylvite (KCl) and rock salt (NaCl). In India, few deposits of potash mineral are reported from Sidhi district of Madhya Pradesh, Sonbhadra district of Uttar Pradesh, Kaimur district of Bihar and Sawai Madhopur and Karauli districts of Rajasthan. It is in the form of Glauconitic (a potassium bearing green mica) sandstone. However, reported occurrences in the country are not commercially exploitable and hence no production of potash is reported from India. The entire requirement of potash to be utilised as fertilizer is therefore met by imports.

## RESERVES/RESOURCES

As per NMI database, based on UNFC system, the total reserves/resources of potash as on 1.4.2015 have been estimated at 22,508 million tonnes, all in remaining resource category. Rajasthan alone contributes 91% to the total reserves/resources, followed by Madhya Pradesh (5%) and Uttar Pradesh (4%) (Table- 1).

## EXPLORATION AND DEVELOPMENT

GSI carried out exploration for glauconite/ potash in Bihar, Madhya Pradesh, Uttar Pradesh and Rajasthan. The details of exploration carried out during 2015-16 are given in Table-2.

## OCCURRENCES

Glauconitic sandstones/greensands deposits can be used as an alternative indigenous resource for potash. Glauconite is essentially a complex hydrous silicate of iron and potassium chiefly with ferric oxide and partly with ferrous oxide. It contains about 4-7% $K_2O$.

In India, glauconite is commonly associated with sand/sandstones, shale, marl and occasionally with limestone. Glauconitic sandstones of Vindhyan Group represent oldest glauconite deposits which are well developed in Son Valley region covering parts of Madhya Pradesh and Uttar Pradesh. In Madhya Pradesh, occurrences are in Sidhi and Satna districts. The

deposits of same origin are located in Banda, Sonbhadra and Mirzapur districts of Uttar Pradesh. Glauconite occurs in shale, limestone and Tal formations at Duggad and Tal Valley in Garhwal and Mussoorie in Dehradun district, Uttarakhand. In Rajasthan, glauconitic sandstones/shales occur in Chittorgarh, Kota, Karauli, Jaisalmer and Barmer districts. In Gujarat, glauconite is found in Ukra Formation at Guneri in Kachchh district. In Himachal Pradesh, glauconite of hydrothermal origin is found in Kumla-Kathwar area of Sirmaur district. In Kerala, glauconite occurs in Quilon Limestone and sea bed sediments of Thiruvananthapuram coast.

## USES

Potash is an essential nutrient for protein synthesis and it aids plants to use water more efficiently. Glauconitic sandstones/greensands are used directly in acidic soils in eco-friendly manner, as glauconitic sand mixes homogeneously with the soil and provides potash as nutrients for plants. It also increases soil fertility and improves soil texture, porosity and permeability due to more or less uniform grain size. Potassium chloride (KCl) is the principal fertilizer product with 60-62% of $K_2O$ equivalent. Other salts, for fertilizer use, are potassium sulphate, potassium magnesium sulphate and potassium nitrate. Potassium chloride and potassium nitrate are used in manufacture of glass, ceramics, soap, synthetic rubber and chemicals. Potassium nitrate is used in explosive manufacture. Potash is also used as a raw material for manufacturing complex fertilizers.

## CONSUMPTION

Domestic consumption of potash in favour of salts was about 1.48 million tonnes in 2015-16 as compared to 1.47 million tonnes in the previous year and the Fertilizer Industry solely accounted for its entire consumption (Table- 3).

**Table – 1 : Reserves/Resources of Potash as on 1.4.2015**
**(By Grades/States)**

(In million tonnes)

| Grade/State | Reserves Total (A) | Remaining Resources | | | | Total Resources (A+B) |
|---|---|---|---|---|---|---|
| | | Indicated STD332 | Inferred STD333 | Reconnaissance STD334 | Total (B) | |
| **All India : Total** | – | **18142** | **3660** | **707** | **22508** | **22508** |
| **By Grades** | | | | | | |
| Glauconite | – | 878 | 1076 | 707 | 2662 | 2662 |
| Polyhalite | – | 13985 | 2179 | – | 16164 | 16164 |
| Sylvite | – | 2072 | 404 | – | 2477 | 2477 |
| Unclassified | – | 1206 | – | – | 1206 | 1206 |
| **By States** | | | | | | |
| Madhya Pradesh | – | 1206 | – | – | 1206 | 1206 |
| Rajasthan | – | 16936 | 3462 | 22 | 20419 | 20419 |
| Uttar Pradesh | – | – | 198 | 685 | 883 | 883 |

*Figures rounded off.*

**Table – 2 : Details of Exploration Activities for Potash, 2015-16**

| Agency/ State/ District | Location Area/ Block | Mapping | | Drilling | | Sampling (No.) | Remarks Reserves/Resources estimated |
|---|---|---|---|---|---|---|---|
| | | Scale | Area (sq km) | No. of boreholes | Meterage | | |
| **GSI** | | | | | | | |
| **GLAUCONITE** | | | | | | | |
| **Bihar** | | | | | | | |
| Kaimur | Adhaura | 1:12500 | - | - | - | 117 | A (G-4) investigation was undertaken in south of Adhaura area in order to delineate the potash-bearing zones and to assess the resources of glauconitic sandstone. The cumulative strike length of the mineralised zone is approximately 3 to 3.5 km including soil covered area between two outcrops. So far only 117 samples have been analysed with highly encouraging results showing $K_2O$ concentration up to 13.79%. Out of the total, 28 samples yielded $K_2O$ content more than 5% and 62 samples yielded more than 4%. Two samples collected from different depths of a dug well at Tiura exposing more than 5 m thick glaunconitic siltstone yielded $K_2O$ concentrations of 13.71% and 13.79%. At Banahi at the contact of Fawn Limestone, glauconitic siltstone yielded 13.02% of $K_2O$. High concentration of $K_2O$ over surface and at depth, persistence of glauconitic sandstone over a considerable distance along strike is indicative of a prospective block for further exploration. |

(Contd.)

Table – 2 (Contd.)

| Agency/ State/ District | Location Area/ Block | Mapping | | Drilling | | Sampling (No.) | Remarks Reserves/Resources estimated |
|---|---|---|---|---|---|---|---|
| | | Scale | Area (sq km) | No. of boreholes | Meterage | | |
| **Madhya Pradesh** | | | | | | | |
| Sidhi | Khunteli village etc. | FS-2014-15 1:12500 | 100 | - | - | 85 | Preliminary investigation (G4) has been carried out for delineation of glauconite-bearing strata. The exploration initiated in 2014-15 was taken up for two years. Total 50 BRS, 20 PCS and 15 PS samples have been collected. The results of chemical analysis are highly convincing especially for shale units. Maximum value of $K_2O$ (5.07-11.52%) was found in alternate sequence of glauconitic shale associated within Fawn Limestone of Bargawan Formation, and hence, considered to be the potential host of glauconite in the target area. Besides, greyish white shale inter-bedded with carbonate band of Arangi Formation also shows potential values of $K_2O$ between 6.24% - 8.23%. Olive (khakhi) shale and thinly laminated intercalated glauconitic shale and sandstone of Basuhari Member of Khenjua Formation also shows encouraging values ranging from 5.17% to 6.4% and 4.26% to 5.16%, respectively. During 2015-16, large scale mapping completed and 19 BRS, 9 PS and 8 PS samples have been collected. |
| | | FS-2015-16 LSM | 58 | - | - | 36 | |

(Contd.)

Table – 2 (Contd.)

| Agency/ State/ District | Location Area/ Block | Mapping | | Drilling | | Sampling (No.) | Remarks Reserves/Resources estimated |
|---|---|---|---|---|---|---|---|
| | | Scale | Area (sq km) | No. of boreholes | Meterage | | |
| **Uttar Pradesh** | | | | | | | |
| Sonbhadra | Barwadih-Kurchha and Patwadh area | - | - | 29 | 1015 | - | A G-2 stage exploration was carried out in this area. Detailed mapping was carried out to delineate glauconite-bearing mineralised zones in glauconitic sandstone /shale.Twenty one drill holes (i.e. BH-1 to BH-21 with total 735 m drilling) in Barwadih Block and 8 drill holes (i.e. KR-1 to KR-8 with total 280 m drilling) in Kurchha Block were drilled each with 35 m average depth. Glauconite mineralisation was observed in coarse- to medium-grained glauconitic sandstone. The volume percentage of glauconite decreases 15-25 m below the surface. On the available chemical data, $K_2O$ content of bedrock samples collected from Patwadh area varies from 1.28 % to 6.52% with average 4.35% in glauconitic sandstone. |
| **Rajasthan** | | | | | | | |
| Sawai Madhopur and Karauli | Bapoti, Kanotipura village | 1:12500 | 150 | 264 | 300 | 502 | As a part of surface exploration, 403 bedrock samples were collected, including 80 pitting/trenching samples. A total length of 300 m has been drilled in scout boreholes. A total of 255 core samples were processed for chemical analysis. 37 rock samples representing different litho units in the area were collected for petrographic study. A total of 5 rock/ mineral samples were also collected and submitted for XRD analysis. The detached band of glauconitic sandstone is recorded near Mahuali. It varies in thickness from 1 to 2 m and extends over a strike length of 2 km. The olive-green Panna shale is glauconitic in nature. The maximum content of $K_2O$ in olive green shale is 5.65% near Bapoti and 4.95% near Kanotipura village.<br>The maximum value of $K_2O$ analysed in Taragarh sandstone is 3%. The youngest formation in the study area is Maihar Sandstone, very limited |

(Contd.)

Table – 2 (Concld.)

| Agency/ State/ District | Location Area/ Block | Mapping | | Drilling | | Sampling (No.) | Remarks Reserves/Resources estimated |
|---|---|---|---|---|---|---|---|
| | | Scale | Area (sq km) | No. of boreholes | Meterage | | |
| (Rajasthan contd.) | | | | | | | exposures intercalated with glauconitic sandstone; lie in NE part of the study area near Mahauli, Kharsai, Rajor and Atwewa areas. The thickness of glauconitic level varies from 0.01 m to 1m. Petrological study indicates that glauconite mineralisation in Panna Shale and Jhiri Shale is of disseminated type and is very fine in nature. In sandstone of Taragarh and Maihar formation glauconite mineralisation is in the form of thin lenses and is coarse in nature.The analytical result of 33 bedrock samples indicates that maximum concentration of potash in olive-green shale of Panna and Jhiri formation is 5.65% and 5.81%, respectively. On the basis of exploration data, broadly, four potential zones have been demarcated. (i) Olive-green shale of Jhiri Formation having strike continuity of about 12 km from Adadungar to Ramapura Ghati, (ii) Olive-green shale of Jhiri Formation having strike continuity of about 4 km from Gothra to Grain, (iii) Olive-green shale of Panna Formation having strike continuity of about 1.5 km near Bapoti and (iv) Olive-green shale of Panna Formation having strike continuity of about 1.5 km near sapotra. |

**Table – 3: Consumption* of Potash Salt 2013-14 to 2015-16 (By Industries)**

(In tonnes)

| Industry | 2013-14 | 2014-15 (R) | 2015-16 (P) |
|---|---|---|---|
| **All Industries** | **1310800** | **1473900** | **1485300** |
| Fertilizer | 1310800 | 1473900 | 1485300 |

*Figures rounded off.*
**Includes actual reported consumption and/or estimates made wherever required. Due to paucity of data, coverage may not be complete.*

# WORLD REVIEW

The world reserves are estimated at approximately 4,300 million tonnes of $K_2O$ content. Deposits are located mainly in Canada (23%), Russia (20%), Belarus (17%), China (8%), Israel, Jordan & USA (6% each), Chile & Germany (3% each) (Table-4).

The world production of potash in 2015 was 37.90 million tonnes in terms of $K_2O$ content as against 39.90 million tonnes in 2014. Canada

remained the leading producer of potash with 30% share in total production in 2015, followed by Russia (18%), Belarus (17%), China (11%), Germany (8%), Jordan (4%) and Chile & Israel ( 3% each) (Table-5).

**Table – 4: World Reserves of Potash (By Principal Countries)**

(In '000 tonnes of $K_2O$ content)

| Country | Reserves |
|---|---|
| **World: Total (rounded off)** | **4300000** |
| Belarus | 750000 |
| Brazil | 13000 |
| Canada | 1000000 |
| Chile | 150000 |
| China | 360000 |
| Germany | 150000 |
| Israel | 270000 |
| Jordan | 270000 |
| Russia | 860000 |
| Spain | 20000 |
| UK | 70000 |
| USA | 270000 |
| Other countries | 90000 |

*Figures rounded off*

***Source:*** *Mineral Commodity Summaries, 2017.*

**Table – 5: World Production of Potash (By Principal Countries)**

(In '000 tonnes of $K_2O$ content)

| Country | 2013 | 2014 | 2015 |
|---|---|---|---|
| **World: Total** | **34179** | **39911** | **37914** |
| Belarus | 4179 | 6340 | 6468 |
| Canada (Chloride) | 10140 | 11345 | 11350 |
| Chile (Chloride) | 1158 | 1108 | 1119 |
| China | 3600 | 4400[e] | 4200[e] |
| Germany (Potassic salt) | 3075 | 3178 | 3110 |
| Israel (Chloride) | 2155 | 2213 | 950 |
| Jordan | 1064 | 1276 | 1437 |
| Russia (Chloride) | 6104 | 7402 | 6954 |
| USA (Potassic salt) | 960 | 850 | 770[e] |
| Other countries | 1743 | 1799 | 1557 |

*Figures rounded off.*

***Source:*** *World Mineral Production, 2011-2015.*

# FOREIGN TRADE

## Exports

Exports of potash fertilizer decreased considerably to 26,715 tonnes in 2015-16 as against 39,052 tonnes in the previous year. Exports were mainly to Turkey (21%), UAE (17%), Netherlands & Belgium (13% each), Saudi Arabia & Peru (7% each) and Brazil (6%). Exports of potassium nitrate also decreased slightly to 1,103 tonnes in 2015-16 from 1,133 tonnes in the previous year. Exports were mainly to Thailand (36%), Bangladesh (26%), USA (16%), China (7%) and Pakistan (4%) (Tables- 6 and 7).

## Imports

Imports of potash fertilizer also decreased drastically to 3.59 million tonnes in 2015-16 from 4.62 million tonnes in the previous year. Canada & Russia were the main suppliers (25% each) followed by Lithuania, Belarus & Israel (11% each) and Jordan (8%). On the other hand imports of potassium nitrate increased considerably to 257 tonnes in 2015-16 from 182 tonnes in the previous year. China (91%) and Israel (8%) were the main suppliers of potassium nitrate in 2015-16 (Tables- 8 and 9).

**Table – 6: Exports of Potash Fertilizers (By Countries)**

| Country | 2014-15 | | 2015-16 (P) | |
|---|---|---|---|---|
| | Qty (t) | Value (`'000) | Qty (t) | Value (`'000) |
| **All Countries** | **39052** | **1122425** | **26715** | **986882** |
| Turkey | 2 | 106 | 5611 | 191545 |
| UAE | 5643 | 190294 | 4633 | 175246 |
| Belgium | - | - | 3470 | 128272 |
| Netherlands | - | - | 3530 | 119679 |
| Saudi Arabia | 572 | 24850 | 1988 | 74245 |
| Peru | 550 | 23080 | 1853 | 65684 |
| Brazil | 1800 | 80630 | 1563 | 58526 |
| Pakistan | 3706 | 118821 | 879 | 27774 |
| Iran | 561 | 22813 | 673 | 24732 |
| Morocco | 300 | 12504 | 584 | 22966 |
| Other countries | 25919 | 649327 | 1931 | 98213 |

## Table – 7: Exports of Potassium Nitrate (By Countries)

| Country | 2014-15 | | 2015-16 (P) | |
|---|---|---|---|---|
| | Qty (t) | Value (`'000) | Qty (t) | Value (`'000) |
| **All Countries** | **1133** | **169325** | **1103** | **181930** |
| Thailand | 470 | 65182 | 402 | 59948 |
| USA | 142 | 43691 | 178 | 54212 |
| China | 67 | 12786 | 81 | 18154 |
| Bangladesh | 182 | 10796 | 284 | 15886 |
| Egypt | 118 | 14607 | 35 | 10831 |
| Pakistan | 10 | 1906 | 41 | 9714 |
| Oman | 1 | 384 | 10 | 2905 |
| Bahrain | 5 | 2035 | 5 | 2263 |
| Saudi Arabia | ++ | 51 | 25 | 1805 |
| Netherlands | - | - | 5 | 1588 |
| Other countries | 138 | 17887 | 37 | 4624 |

## Table – 8: Imports of Potash Fertilizers (By Countries)

| Country | 2014-15 | | 2015-16 (P) | |
|---|---|---|---|---|
| | Qty (t) | Value (`'000) | Qty (t) | Value (`'000) |
| **All Countries** | **4620668** | **92745062** | **3594923** | **78216423** |
| Canada | 1145382 | 22538185 | 904148 | 19639067 |
| Russia | 1275123 | 24710551 | 896162 | 19239559 |
| Lithuania | 277715 | 5324208 | 409471 | 8689081 |
| Belarus | 456711 | 8908105 | 409222 | 8514369 |
| Israel | 658061 | 12994608 | 379529 | 8243646 |
| Jordan | 346880 | 7780427 | 274462 | 6043406 |
| Germany | 180626 | 4585504 | 138352 | 3344540 |
| Indonesia | 87317 | 1809835 | 66288 | 1470220 |
| Uzbekistan | 12099 | 247777 | 29701 | 601138 |
| Unspecified | 16000 | 310426 | 62999 | 1336358 |
| Other countries | 164754 | 3535436 | 24589 | 1095039 |

## Table – 9: Imports of Potassium Nitrate (By Countries)

| Country | 2014-15 | | 2015-16 (P) | |
|---|---|---|---|---|
| | Qty (t) | Value (`'000) | Qty (t) | Value (`'000) |
| **All Countries** | **182** | **21501** | **257** | **24821** |
| China | 129 | 9499 | 233 | 20667 |
| Israel | - | - | 21 | 1682 |
| Italy | - | - | 1 | 978 |
| Germany | 1 | 270 | 1 | 631 |
| USA | ++ | 276 | ++ | 423 |
| UAE | - | - | 1 | 349 |
| Belgium | ++ | 5 | ++ | 60 |
| Netherlands | 1 | 236 | ++ | 31 |
| Korea, Rep. of | 50 | 10611 | - | - |
| Austria | 1 | 589 | - | - |
| Other countries | ++ | 15 | - | - |