The International Journal of Frontier Sciences

Water: The Elixir of Life

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Submitted: November 10, 2018
Accepted: December 25, 2018
Published Online: January 1, 2019
doi: 10.5281/zenodo.2539510
How to cite this: Aslamkhan, A. 2019. Water: The Elixir of Life. Int J Front Sci, 3(1), 64-72.

Water is a chemical compound made up of two elements, Hydrogen gas, which is combustible and Oxygen gas, which causes to burn. But the union of two atoms of Hydrogen and one atom of Oxygen results in a colourless and odourless liquid, known as water, which extinguish fire.

On this planet earth water is one of the most plentiful compound that exist as solid, liquid and gaseous state. In nature it also occurs as snow, ice packs, icebergs, glaciers, fog, dew, clouds, aquifers and atmospheric humidity, but on room temperature it is liquid that has the property to dissolve many other substances, which makes it a universal solvent. Water is essential to all micro and macro living beings, whether plants or animals. Life, it is believed, originated in aqueous solution. In human beings, water constitutes circa 60% of the body fluids and is essential for all biological processes, *e.g*., aqueous solution of blood and digestive juices. Though its molecule - H_2O - is simple in structure but its physical and chemical properties are quite complicated and unique, not found in other substances in our environment, *e.g.,* solid state of a compound is denser than its liquid state that sink, yet ice floats in water. This phenomenon is very important for the survival of aquatic life in a frozen lake where the ice, instead of sinking, floats on the surface and act as a barrier for the aquatic life below, which overwinter the harsh cold season.

Water, under normal climatic environment, occurs as liquid, which makes it a suitable habitat for millions of plants and animal life, as well as a mode of transportation for living organism. During hot weather it readily changes to vapours, rises up and moves in the atmosphere from place to place as cloud. On condensation it falls as rain. This is known as hydrologic cycle that is so vital for the nourishment of the living being on earth.

Water has played a pivotal role in the religious and philosophical cultures of mankind. It was regarded as the building block of matter by the Greeks in the 6th century BCE. Aristotle, in the 4th century BCE, named water along with air, fire and earth as the main elements. This notion persisted up to second half of the 18th century CE, when it was found that water is a compound of two elements – Hydrogen and Oxygen.

On earth 96.5% water is present in oceans and seas, which is brackish containing large amount of various salts, thus cannot be used for human consumption. Of the remaining, only 1.7 % is freshwater while 1.7 % water is present in the form of snow and ice on polar caps and glaciers. In the form of clouds in the air it is only 0.001% and lakes, ponds and rivers contain 0.3% fresh-water, which is the main source of potable and useable water for human consumption and agriculture. Very small amount (0.003%) of the Earth's freshwater is contained within biological bodies. A great quantity of water, which is hard to estimate, is found in the earth's interior.

STATUS OF WATER IN PAKISTAN:

Pakistan is the new name of a very ancient land in the north-west of the Indian sub-continent. It is watered by circa 43 rivers and their large and small tributaries rivers, 32 lakes and 3 coastal regions. Earliest migrants/invaders from the west traversing difficult mountain passes and glaciers stopped at the bank of a mighty river, which they named "Sin" to honour their Roman-Greek goddess of water and respectfully called it as "Aba-Sin" or Father Sin. Who were those people? Were those the same people who named the river in southwest of Europe as "Seine" in reverence of their Roman goddess of water? Be as it may, but archaeologists, anthropologists and linguists tell us the invasion and influx of Arians (1800 BCE to 500 CE) from the Central Asia. Arians annihilated the aborigines, stopped at the mighty river, which was known to the Assyrians, as early as 7th century BCE, as *Sinda*, to the ancient Persian, in Zend Avasta, as *Hendu*, to the Greek as *Ind*os and to the Chinese as *Sintow*. The Arians called it *Sindhu* in the Indo-European language – Sanskrit.

According to the *Rig Veda*, Arians found 7 rivers flowing in the land, uniting together as *Sapt-Nad.* They named the conquered area as "*Sapta-Sindhvas"*- the Land of Seven Rivers - which is mentioned as "*Hapta Hendu"* in ancient Persian literature of Zend Avesta; and the people inhabiting the western plains of the river were called as *Sindhu* (or *Hindu*). The *Sapta-Sindhvas* region, as given in the *Rig Veda*, stretched from Gandhara to Kurukshetra. Sapta Sindhvas contained the *Sindhu Nadi* in the west, flowing from north to southwest, followed next by the six rivers: *Vitasta* (Jhelum), *Asikni* (Chenab), *Parusni* (Ravi), *Vipasa* (Beas), *Sutudri* (Sutlej) and *Sarasvati* (Sarspti*)*. These seven rivers and their tributaries formed what is known as the Indus River System. Let us explore the seven rivers of *Sapta Sindhvas* Land:

1. *Sindhu Nadi (*The Indus River):

Sindhu Nadi, or Abasin, is not only the main river of *Sapta Sindhvas* but also a major river in South Asia. Originating in the Chinese Tibetan Plateau, in the vicinity of Mansarover Lake, Indus flows through Ladakh, Jammu and Kashmir towards Gilgit-Baltistan, then it flows in a southerly direction along the entire length of Khyber Pakhtunkhwa, Punjab and Sindh, and empties itself into the Arabian Sea near Karachi, after covering a distance of 3180 km. The river has a total area of drainage exceeding 1,165,000 sq km. Its estimated annual flow stands at circa 207 cu km; thus, in terms of annual flow, makes it the 21st largest river in the world. Indus has 10 major tributaries on the

left bank and 5 on the right, which are as follows:

The Zanskar River is the first left-bank tributary, which has two main sources in the upper reaches of Himalayas. The Doda River and Lungnak River, the last also has two tributaries, Kargyag River and Tasarap River. These form the Zanskar River, which takes a north-eastern course to joins the Indus River.

The Shyok River originates from the Rino Glacier, one of the tongues of the Siachen Glacier (76 km long), where it is called *"The River of Death"*. After spanning some 550 km it flows through Ladakh, India, and the district of Ghangche of Gilgit-Baltistan. The Shyok River receives the following 5 tributaries. Chang Chen Mo River, Galwan River, Nubra River, Saltoro River and Hushe River. Finally, the Shyok joins the Indus at Keris, east of of Iskardu.

The Shigar River is formed from the melt water of the Baltoro Glacier (63 km) one of the longest glacier outside the Poles. It flows through the Shigar Valley and empties itself into the Indus at Iskardu.

The Hunza River is formed by the Khunjerab gorge and flows south receiving water from Misgar River, Chepursan River, and Naltar River. The river cuts through the Karakorum Range, flowing from north to south along the Karakorum Highway and joins the Gilgit River before it flows into the Indus River. A landslide disaster in January 2010, completely blocked the Hunza River and valley. The disaster created a 30 km long new lake on Hunza River, called the Ataabad Lake.

The Gilgit River, a right bank tributary of Indus, starts from Shandur Lake (3,700 m) and runs eastwards through beautiful Phander Valley where it forms Phander Lake. Passing the town of Chassi it enters Ghizer Valley and known as Ghizer River. Further eastwards it passes the town of Gilgit. The 240 km long Gilgit River joins the Indus River at Juglot, a town situated 45 km southeast of Gilgit on the Karakorum Highway. It is located at the junction of three mightiest mountain ranges, the Hindukush, the Karakorum and the Himalayas.

The Kabul River is a 700-km long right bank tributary of Indus that emerges in the Sanglakh Range of the Hindu Kush mountains in Afghanistan, where it passes through the cities of Kabul, Surobi and Jalalabad before entering Pakistan. In Khyber Pakhtunkhwa, the river passes through the cities of Peshawar, Charsadda and Noushera. The Kabul River has the following 7 major tributaries all originating from the Hindu Kush: Logar River (originates in Maidan Wardak Province where it is called Chak River); **The Panjshir River (**flows through the Panjshir Valley of Afghanistan. Its main tributary is the Ghorband River which joins it 10 km east of Charikar. The Panjshir River flows southward through the Hindukash and joins the Kabul River at the town of Sarobi. A dam was built on the Panjshir River near Surobi in the 1950s. **Alingar River** originates in Lamghan Province of eastern Afghanistan. It joins the Kabul River a part of the Indus River Basin; The **Surkhab River** rises in the district of Azra in the far north of Paktia Province. The Surkhab receives many tributaries, especially on its right bank from the melting snows. It enters

the Kabul River some 10 km west of Jalalabad. **The Kunar River** also called the Chitral River or the Kama River, rises in the Hindu Kush Mountain at Chitral. Downstream as far as Mastuj it is known as the Mastuj River from there to its confluence with the Lotkoh River just north of Chitral and called the Chitral River, before flowing south into the upper Kunar Valley. At the confluence in Chaga Sarai, it meets with Pech River and finally empties into the Kabul River, east of Jalalabad. The combined rivers then flow eastwards into Pakistan and joining the Indus at the city of Attock; **The Bara River** originates in the Tirah Valley of Khyber Agency. It joins the Kabul River Canal which originates from the Warsak Dam. Flowing north-easterly direction it reaches Naushera to join the Kabul River. **The Swat River,** named as *Suvastu* ("clear azure water") in Rigveda, commences in Swat Kohistan region of the Kalam Valley with the confluence of two main tributaries Ushu River and Gabral River in Utror Valley. Swat River is fed by the glacial waters and flows through the Kalam Valley up to Madyan and lower plain areas of Swat Valley up to Chakdara for 160 km. In the extreme south of the valley, the river enters a narrow gorge and joins the Panjkora River, at Qalangi, and finally empties near Charsadda into Kabul River, which finally empties into the Indus River near Attock, Punjab. Swat River is diverted near Batkhela for irrigation and power generation at Jabban and Dargai Power Stations.

The Gomal River is a 400 km long river with headwaters located south-east of Ghazni. It has two tributaries: the "Second Gomal" that joins it circa 14 miles below its source, and the Zhob River, that joins it near Khajuri Kach. Within Pakistan, the Gomal River surrounds the South Wazirastan, then it enters the Gomal Valley in the district of Tank. The river passes then through the Damaan plain in Kulachi tehsil. It then joins the Indus River 20 miles south of Dera Ismail Khan. The drainage of this river at Khajuri Kachh was envisaged as back as 1898, even after its administrative approval by the Government of Pakistan in 1963, work on the Gomal Zam Dam was stopped in 1965; not to restart till 2001, and it was opened in 2013.

The Kurram River is a right bank tributary of the Indus River, located in Paktia and Khost provinces of Afghanistan and Kurrama and North Waziristan, Khyber Pakhtunkhwa. It drains the southern flanks of the Spin Ghar mountain range. It has two tributaries: the Kirman River and the Khurmana River.

The Soan River is an important stream and drainage system of the Potohar region of the Punjab, Pakistan. It starts near a small village Bun in the foothills of Patriata and Murree Hills. Near Pharwala Fort, it cuts through a high mountain range, a wonderful natural phenomenon called “Soan Cut” Ling Stream, follows a relatively long course through Lehtrar and Kahuta. Islamabad Highway crosses this stream near Sihala where the famous Kak Pul is constructed over it. The Ling Stream joins the Soan River just before the Kak Pul. The Korang River joins it just before the Soan Bridge and Lai Stream joins it after the Soan Bridge. After flowing a big curve, the stream reaches Kalabagh proposed Dam Site close to Pirpiyahi where it empties itself in to the Indus River after running more than 250 kilometres. Soan River ecologically

is very viable, and its Soan Culture provided sustainable environment for human developmental biology, which dates back to 1.9 million years at Riwat, a lover Paleolithic site providing evidence of *Homo* occupation that is the earliest outside Africa, and 45,000 years ago Stone-age man roaming there has left many stone tools evidences of his existence in the Soan valley of Potohar. Soan River provides water to Simly Dam, which is the water reservoir for Islamabad, the capital of Pakistan.

2. *Vitasta* Nadi (The Jhelum River):

The ancient Greeks named it as Hydaspes after the name of their god. Jhelum River has a total length of circa 725 km. The Jhelum River originates from Verinag Spring near Sonamarg at the foot of the Pir Panjal (Kashmir Valley). Its average drainage rate at Baramulla is: 221.9 m^3/s. It receives its first tributary, the Lidder River at Martand, flows west to receive its second tributary, the Sind River, at Shadipora. Jhelum River then flows through Srinagar and the Wular Lake before entering Pakistan, where it is joined by its largest tributary, the Neelum River, at Domel, Muzaffarabad as does the next largest, the Kunhar River of the Kaghan Valley. River Jhelam then receive waters from the Poonch River, and flow into the Mangla Dam. The Jhelum enters the Punjab in the District of Jhelum, where Alexander, the Great in 326 BCE had a fierce battle with King Porua (Porus in Greek). In that battle on the River Hydaspes, Alexander won the battle losing his horse Bucephalus and Porua his son. Alexander built a city to honor his horse and name it as *Bucephalus*. It survives on the left bank of River Jhelum as a small village called "Bukephla". From there, it flows through the plains of the Punjab, forming the boundary between the Chaj and Sind Sagar Doab. It ends in a confluence with the Chenab River at Trimmu in district Jhang.

DAM: A multipurpose reservoir is built on the Jhelum River in the district of Mirpur, named Mangla Dam, that is the seventh largest in the world with a height of 147 m and length of 3,140 m with a total capacity of 9.12 km^3.The dam was constructed between 1961 and 1965, at a cost of PKR 15.587 billion (US$1.473 billion).

2.1. The Lidder River is a first tributary originating from Kolhoi Glacier (4,653 m) that joins the Jhelum River at Mirgund Khanabal near Anantnag, at an altitude of 1,615 m.

2.2. The Sind River is the second tributary, which forms the Sind valley in the district of Ganderbal, originates at Machori Glacier 4,800 m, east of Amarnath temple south of Zoji La. It is a major tributary of the Jhelum River and is 108 km long.

HYDROELECTRIC POWER PLANT: On its way south Jhelum River is fed by many glacial streams and has three functional power plants: (a) First Upper Sind Hydroelectric Power project at Sunbal, (b) Second Upper Sind Hydroelectric Power Project at Kangan, and (c) Lower Sind Hydroelectric Power Project at Ganderbal.

2.3. The Neelam River also known as Krishan Ganga, originates from Krishan Sar Lake at an elevation of 3,710 m near Sonamarg, Kashmir. It runs northwards to meet a tributary and then runs westwards along the Line of Control. On its way it receives many glacial tributary streams and

enters Azad Kashmir in the Gurez sector of the Line of Control. Running west it reaches Muzaffarabad and empties in the Jhelum River at Dimel. Its average discharge is 465 m^3/s. The Neelam River is 245 km long - 50 km in Indian held Jammu and Kashmir and 195 km in Azad Kashmir.

DAM: A 330 MW Krishanganga Hydoelectric Plant Project has started by India. The proposed 37-meter reservoir will submerge some parts of the Gurez Valley. The water of Neelam River will be diverted through a 24 km tunnel dug through the mountains to Bandipur where it will join the Wular Lake in Srinagar. Pakistan claims that the Indian dam project will violate the Indus Waters Treaty and has pursued formal arbitration proceedings against India over the matter. Pakistan is proposing to construct a 969 MW Neelam – Jhelum Hydropower Plant.

2.4. The Kunhar River originates from the Laluser Lake (3,410 m), nearly 48 km upstream from Naran village. Waters of Dudipat Lake (Surface elevation: 800 m) and Saiful Muluk Lake (3,410 m) as well as glacial water of Malka Parbat (3,410 m) feed the river. The Kunhar River is 166 km long, flows through the entire Kaghan Valley, Balakot, Garhi Habibullah, Dalola, etc. It then joins with the Jhelum River near Kohala Bridge, that connects Azad Jammu and Kashmir with the Punjab, Pakistan. River Jhelam then receive waters from the Poonch River, and flow into the Mangala Dam. The waters of the Jhelum are allocated to Pakistan under the terms of the Indus Water Treary. India is working on a hydropower project on a tributary of Jhelum River

2.5. The Poonch River originates in the south-facing foothills of Pir Panjal range, in the areas of Neel-Kanth Gali and Jamian Gali. It is called 'Siran' (Suran) in this area. It flows south and then west until reaching the Poonch town, after which it bends southwest, finally draining into the Mangla Lake near Chomukh. The towns of Poonch, Sehra, Tatta Pani, Kotli and Mirpur are situated on the banks of this river. The Poonch River has several tributaries: Mandi, Nimbal Katha, Darungli, Betaar, Ranguri, Rangar, Menthar, Nail, Baan, Mahuli, and Khad. The famous Mughal Road from Shopian circles around the origin of the Poonch River and runs along its banks.

3. *Asikini* Madi (The Chenab River):

It is formed s at Bara Lacha Pass in the Upper Himalayas in the districts of Lahaul and Spiti of Himachal Pradesh, India. Bara-lacha la, (4,890 m) is a high mountain pass in Zanskar range, connecting Lahul district to Ladakh situated along the Leh-Manali Highway. There are three rivers originating from Baralacha Massif, which are Chandra, Bhaga and Yunam. Chandra and Bhaga meet at Tandi and form the Chander-bhaga Sangam whereas Yunam River moves to other direction in Zanskar. Chenab becomes very significant once we recall the eternal love stories of Heer Ranjha, Sohni Mahiwal and Suni Bhunku It flows through the district of Kishtwar of Jammu region, enters the district of Gujrat and flows into the plains of the Punjab, before flowing into the Indus River near the city of Uch Sharif. The Chenab merges with the Satlaj to form the Panjnad River which joins the Indus River at Mithankot. Alexander, the Great, in 325 BCE founded the town of Alexandria on the Indus,

which has been located by the archaeologist at the present day Uch Sharif or Mithankot at the confluence of the Indus and the combined stream of Punjab rivers (currently known as the Panjnad River).

DAMS AND HYDOELECTRIC POWER PLANTS ON THE CHENAB RIVER: The waters of the Chenab are allocated to Pakistan under the terms of the Indus Water Treaty. a. Salal Dam: 690 MW hydroelectric power project in Jammu and Kashmir, India. b. Baglihar Dam: a hydroelectric power project in Jammu and Kashmir, India. c. Pakal Dul Dam - a proposed dam on Marusadar River, a right bank tributary of Chenab River. d. Dal Hasti Hydroelectric Plant: 390 MW run-of-the-river type power project. e. Ratle Hydroelectric Power Plant: an under-construction power station of run-of-the-river type. f. Kira Hydro Electric Power Plant: a 624 MW proposed project located in the district of Kishtwar. g. Kwar Hydro Electric Power Plant: a 540 MW proposed project located in the district of Kishtwar. h. Marala Headworks: located near Sialkot district of Pakistan. i. Khanki Headworks: located in the district of Gujranwala, Pakistan. j. Trimmu Barage: located in the district of Jhang.

3.1. The Bhaga River is a tributary of the Chanab River locally known as Chandrabhaga, which originates from Surya Tal, situated a few kilometers from the pass towards Manali.

3.2. The Chandra River is the second major tributary of the Chandrabhaga/Chenab, that also originates from glacier in the region of Bara-lacha La. The pass also acts as a water-divide between the Bhaga River and the Yunam River.

4. *Parusni Nadi* (The Ravi River):
It originates in the district of Kangra, Himachal Pradesh, India. It follows a north-westerly course. It rises from glacier fields and flows through Barabhangal, Bara Bansu and Chamba districts. The river drains a total catchment area of 14,442 sq km in India. The Ravi River in this reach flows with a river bed slope of 183 feet per mile and is mostly fed by snow melt through many tributaries.

4.1. The Budhil River rises in Lahul range of hills and the lake Manimahesh (4,080 m). The Budhil River is 72 km long with a bed slope of 314 feet per mile. It flows through the ancient capital of Bharmwar in Himachal Pradesh.

4.2. The Nai River rises at Kali Debi Pass, and flows for 48 km with a bed slope of 366 feet per mile, from its source at Trilokinath to its confluence with the Ravi River.

4.3. The Seul River is a major tributary of the Ravi River, just below Bharmour, the old capital of Chamba. The valley formed by the river has large terraces, which are very fertile and known as "the garden of Chamba".

4.4. The Siawa River is another major tributary that joins the Ravi River near Bissoli. This river originates from the Jammu region.

4.5. The Baira-Nalla originates in the Chamba district, located above Tissa. Baira drains the southern slopes of the Pir Panjal

Range. The valley has an elevation variation between 5,321 m and 2,693 m.

4.6. Tant Gari River rises from the subsidiary hill ranges of the Pir Panjal Range east of Bharmour. The waters of Ravi are allocated to India under the Indus Water Treaty of 1960.

5. *Vipasa Nadi* (The Beas River):

It rises in the central Himachal Pradesh, India. Its total length is 470 km with 20,303 sq km large drainage basin. It traverses the Mandi district, enters the Kangra district at Sandhol (590 m). On meeting the Sivalik Hills in Hoshiarpur, the river sweeps sharply northward. Finally, the Beas joins the river Sutlej at the south-western boundary of Kapurthala district of the Panjab. Chief tributaries of Beas River are: 5.1. Bain River, 5.2. Banganga River, 5.3. Luni River and 5.4. Uhal River. The Beas River marks the eastern-most border of Alexander, the Great, conquest in 326 BCE where his troops refused to cross the river and go any further, as they had been away from home for eight years. Alexander shut himself in his tent for three days, but when his men did not change their desires he gave in, raising twelve colossal altars to mark the limit and glory of his expedition.

DAMS: a. Hydro-Electric Power Project. In the 20th century, the river was developed under the Beas Project for irrigation and Hydro-Electric power generation purposes. b. The Pong Dam. The second-phase of the Dam was completed in 1974. c. Pandoh Dam. The first-phase 140 km upstream, Pandoh Dam was started in 1977. The Pong Dam served initially to primarily provide irrigation below Talwara but was soon developed as well for power generation; its power station has a 360 MW installed capacity. d. Dehar Power Station. A 990 MW Dehar Power Station was completed by diverting the river through a system of tunnels and channels to the 990 MW Dehar Power Station on connecting the Ravi to Sutlej River. The water of the Beas River is allocated to India under the terms of the Indus Water Treaty between India and Pakistan.

6. *Sutudri Nadi* (The Sutlej River):

It arises west of Lake Rakshastal in Chinese Tibet, at an elevation of 4,575 m. It is circa 1,500 km long with circa 395,000 km^2 basin drain area. The nascent river flows at first west-northwest for about 260 km under the Tibetan name Langqen Zangbo (*Elephant River*) to the Shipki La and enters India in Himachal Pradesh state. It then turns west-southwest for about 360 km to meet the Beas River near Makhu, Firozpur district. Ropar Wetland is located on the Sutlej river basin where its average discharge is 500 m^3/s. Ungti Chu and Pare Chu rivers, which drain south eastern part of Jammu and Kashmir are tributaries of Sutlej River. Continuing west-southwest, the Sutlej River enters Pakistan about 15 km east of Bhedian Klan, Kasur district. Continuing southwest it waters the ancient and historical Bahawalpur. About 17 km north of Uch Sharif, the Sutlej unites with the Chenab River. Thus, the union of five rivers, *viz.*, Jhelum, Chenab, Ravi, Beas, and Sutlej is now called as Panjnad River, which finally flows into the Indus River about 100 km west of the city of Bahawalpur.

7. *Sarasvati Nadi Gha* (The Ghaggar-Hakra River System):

It is the seventh River of Sapta Sindhvas (The Land of Seven Rivers) as mentioned in the Rig Veda, which is originated when the Vedic people lived on its banks, during the 2nd millennium BCE. Originating in the western Himalayas, Sarasvati took a southwestern course and, on its way received water from all the 5 rivers of the Punjab, running through Cholistan it emptied into the Sindhu, which was then called "*Sapt Nad*". In Zend Avesta it is named as *"Haft Nad"* (seven rivers). Geologic changes in the Himalayas forced Sarasvati to change its course from northwest to straight south to empty itself in the Rann of Kutch. Further changes forced Sarasvati to flow northeast to become a part of the Gangetic River System. In Rigveda we see Sarasvati begging *Nother Dharti* to open her bosom so that she hides herself as she cannot bear the deeds of her children of Kaljuga. In spite of pleas of Mother Earth, Sarasvati kept on insisting and finally hid herself in Mother Earth. Thus, Sarasvati dried up in the desert. The remains of the Vedic Sarasvati River is the Ghaggar-Hakra River**,** which flows through northwestern India and eastern Pakistan. The Hakra River is the dried-out channel of a river in Pakistan that is the continuation of the Ghaggar River in India. The Indus then flows through a gorge near Sukkar and the fertile plains region of Sindh, forming a large delta region and finally terminating in the Arabian Sea at Karachi, Pakistan.

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