

Atomism Theory: Indian & Western Perspective

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Abstract

The atomism and atomic theory are differentiated on philosophical and scientific basis, but the thing is to have some similarities. The Kanad's theory came in 2nd century BC and the scientific atomic theory were proposed after 19th century. The 'añu' that was experimented by using microscopes, was already experienced and mentioned in the Vaisheshik sutra by Kanad. Here some important questions may be raised that, Is paramañu by Vaisheshik and Dalton same? Is the microscopic view visible of añu? How are the partless atoms combined? Are atoms enough to create varieties of object of world or is any external power necessary? This paper delves into the intersection of atomism theory with the modern domains of polymer science and composite materials, exploring both Indian and Western perspectives. This aims to provide a critical analysis of the concept of atomism within philosophy and also its relation, similarities and differentiation to scientific views. By integrating insights, researchers can gain deeper insights into the fundamental nature of matter and unlock new frontiers in materials science and engineering.

Keywords: Paramañu, Añu, Atom, Atomism, Composite, Material science.

INTRODUCTION

The creation of universe has always been the major quest among the philosophers and scientists. The science has explored at its greatest extent till now, the forces present in the nature has brought up through investigations and experiments, then it be of gravity, electromagnetism, nuclear forces etc and one of the major theories is of atom. Atom has been described as the smallest, indivisible particle in any substance. Though the scientists have proved the theory through many experiments but our philosophers had already predicted or experienced these subtlest particles through their sadhana and explained it in their philosophy.

“Yatha pinde tatha brahmande”, the Yajur Veda sutra explains the universe has the same composition as of the body. The body is made of five elements and so is the universe. Therefore, the subtlest particle of these elements is only explained as añu. The history on atomism shows that many philosophers have been keen to know about añu. Kanada from Indian and Democritus from Western has shown their views and theories in it. The different atomic theories then emerged forward keeping them as the base. Though the clear views are not given but some inferences show that the views were taken from these ancient theories¹.

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Received Date: March 01, 2024

Accepted Date: June 10 2024

Published Date: July 17, 2024

Citation: Ankit Sharma, Shivani Kothari. Atomism Theory: Indian & Western Perspective. Journal of Polymer & Composites. 2024; 12(Special Issue 4): S87–S95.

INDIAN ATOMISM

The Indian philosophy is divided into two parts, the astika and the nastika. Among these school, Nyāya and vaisheshika became the champions in exploring the atomism. Their theory of causation is called Paramañu-karana-vada. The mimamsa is divided into Bhatt mimamsa and Prabhakara mimamsa, both accept the atomic theory. All schools somewhere accepted the atomic theory but kept it secondary. The Upanishads understood this as energy, though the concept of añu is less mentioned, the kathopanishad.

अणोरणीयान्महतो महीया-नात्माऽस्य जन्तोर्निहितो गुहायाम्। तमक्रतुः पश्यति वीतशोको धातुप्रसादान्महिमानमात्मनः॥

Lesser than the atom greater than the greater self is contained in the heart cavity of the being. When a man free himself from lustful thoughts and devoid of sorrow, then he sees him with the offering of purification of mental tendencies, he sees the glory of Ātma sattā^{1,2}.

Chhândogaya Upanishad says ““This light represents the inner essence within the human body. It becomes visible to the extent that one perceives warmth upon touching the body. And the same light is heard when you close your ears and hear some bellowing sound. The subtle particles are añu’s.”

Añuvada is given more importance by Vaisheshik and the Nyāya, the two allied system of philosophy. Mehrishi Kanad majorly accepts the añuvada theory and gave it a vast exposition.

D.P Chattopadhyaya writes, “There is no doubt that the Jain, Vaisheshik, Sautrantikas and even the mimamsa gave support to atomic hypothesis. But it was not so important for their system as it was for Nyāya- vaisheshika. The hypothesis was seriously posed and defended in the Vaisheshik sutras of Kanāda.” From an Indian perspective, polymers and composites can be understood in terms of the combination and arrangement of paramāñus. Just as Western atomism explains the properties of materials in terms of the interactions between atoms and molecules, Vaiśeṣika atomism provides a framework for understanding the structure and behavior of polymers and composites based on the arrangement and combination of paramāñus.

Both Vaisheshik and Nyāya believed in asatkaryavad, which is known as arambhvada or paramāñukaranvada. The theory states that effect does not pre-exist in its cause. The theory posits that effects do not exist before their causes. According to this perspective, each effect represents a novel emergence.² The Buddhist sect mentioned atom as ‘kalapa’ and the Jains as ‘paramāñu’. The Jains mentioned dravya as ‘pudgal’ and its subtlest particle as ‘paramāñu’. Among the Indian philosophies, the most ancient one is the Vaisheshik darshan. The yogā philosophy too understood the atom as param añu or the subtlest particle. The Vaisheshik, Jain and Buddhist understood añu on creation basis. Further Democritus and Leucippus too gave their views and the Scientific theory by Dalton was then proposed and was the first and foremost work on atom in experimentation platform.^{3,4}

BUDDHISTS

Even today the core teachings of Buddhism remain uncontroversial and they always do a good job of training the mind if you focus your attention on them. Buddhist used the word ‘kalapa’ or ‘rupa-kalapa’. This term was used by Theravada Buddhist phenomenology. The kalpas are not mentioned in earlier Buddhist text (tripitakas) but only in Abhidhamma commentary dated 11th or 12th century. Hinayana Buddhists gave these theories and their scriptures were written in Pali. This is followed in Sri Lanka, Myanmar, Thailand, Cambodia and Laos. Hinayana is also accepted as ‘Theravada’³.

The rupa kalapa study shows the Theravada counterpart the atomic theory of sanskrit buddhism (mahayana), it can be seen very probable that the former was formulated on the basis of latter.(reference). In the Vishuddhimaga sannaya⁴ where we find the earliest traces of atomism in the Theravada, the term ‘kalapa’ is not used in medieval works. The Vishuddhimaga for e.g. says that head hair is ‘atthadhamma kalapa’⁵ ‘eight element unit’.^{5,6}

Nowhere in Vishuddhi Marga, an early form of Buddhist atomism, is there any explicit implication that the final or ultimate state of matter is made up of atoms. Therefore, the term "Kalapa", whether singular or plural, is used interchangeably with the same meaning. In the Vishuddhimarga, where atomism was first introduced into Theravada Buddhism, the ultimate unity is called 'paramāñu' or 'cunña' (atom). However, later works default to the term "Kalapa". Notably, Buddhist atomism is

commonly found among practitioners of the "Vipassana" form of Buddhist meditation. Atomic theory is popular among Buddhists in Myanmar and follows the most developed atomic theory of Buddhaghosa scholars. Vipassana Atomic Theory (Kalapa) consists of at least eight material elements that are virtually indivisible. Therefore, it must be noted that Vipassana is not the same as the atom of science. They are only etymologically the same. H. in the sense that they are "inseparable".

JAINISM

Jain philosophy stands out for its strong commitment to realism, setting it apart from other prominent Indian philosophies like Vedanta and Buddhism, which it characterizes as holding absolutist views. Vedanta posits that reality is an all-encompassing existence, considering multiplicity as a mere illusion. In contrast, Buddhists adhere to the belief in distinct atomic particulars with no inherent connection among them. Conversely, Jains assert that universality and particularity are qualities rather than substances, and they coexist in a harmonious synthesis. Jains perceive reality as a synthesis that encompasses both unity and multiplicity.

In Jain metaphysics, 'dravya' (substance) denotes an actual existence distinguished by its enduring nature amidst transformations. Some proponents of absolutism discern a self-contradiction in affirming both permanence and alteration within the confines of the same reality, the non-absolutist Jains embrace this as truth, as it aligns with common experience. They reject the unchanging permanent reality proposed by the Vedantists and Parmenides.

Hence, according to Jain doctrine, substance (dravya) is described as something capable of perpetually enduring existence through an endless cycle of origination and cessation."⁷ Additionally, it is defined as something that encompasses an infinite array of attributes."

Jains assert the reality of substance, emphasizing the dynamic nature of matter, which exhibits permanent substantiality through its continuous cycle of origination and cessation.

According to Jain belief, six fundamental real substances exist.

1. Dharmāstikaya - Medium associated with Motion.
2. Adharmāstikāya - Medium associated with Rest.
3. Ākāśastikāya - Space.
4. Jīvāstikāya - Individual Soul.
5. Pudgalāstikaya - Matter and Energy.
6. Kāla – Time.

The initial five substances are termed 'astikāya' as each of them comprises a cohesive and consistent entity composed of numerous components. The sixth substance on the list is "kāla" (time), but it does not fall under the category of "astikāya." The term "astikāya" is a combination of 'asti' (real existence) and 'kaya' (extensive body), signifying a real extensive magnitude with multiple parts (pradeśa) in its constitution. In Jain philosophy, modern science's matter and energy are known as "pudgala." This term finds extensive usage in Jain literature and is a compound word consisting of 'pud' (union or amalgamation) and 'gala' (separation or disintegration)."

The smallest indivisible unit of 'pudgala' is termed as 'paramāṇu' or the ultimate primary atom. "Paramāṇu" is eternal, neither created nor destroyed. Although possessing sense-qualities, it cannot be perceived through the senses and is the most subtle physical entity. In the atomic structure of physical substances, "paramāṇu" represents the fundamental unit of the entire physical reality, indestructible and forming a single class of "pudgala." It's essential to note that this unity is substance-wise (dravyarthika) and not modification-wise (paryarthika), as Jains do not accept the concept of absolute monism, suggesting that all ultimate atoms are identical.

"Paramāṇu" serves as the ultimate building block of the physical reality, capable of existing freely and combining with other "paramāṇus" to form composite bodies known as "Skandha." Any changes in this physical reality arise due to the fission or fusion of "paramāṇu. As a result, physical reality can be classified into two types: (i) 'Paramāṇu' or freely existing ultimate atoms, and (ii) 'Skandha' or composite aggregates formed from two to an infinite number of atoms.⁸

YOGĀ

The yogā philosophy is propounded by Maharishi Patanjali. This philosophy explains about the practice for the realization of ultimate truth. The term 'yoga' signifies union, specifically the union of the individual with the supreme soul. In sanskrit, yogā comes from 'yuj' dhatu meaning related to 'युज समाधौ', that is, leading towards samadhi. The yogā and samkhya are closely associated with each other. The atomism of Patanjali is not highly mentioned but the sutra परमाणु परममहत्त्वान्तोऽस्य वशीकारः⁹ uses the word paramāṇu. Though the word has been mentioned here as the subtlest particle, mahabhashya by Vyāsji explains it thoroughly relating the sutra with Vaisheshik philosophy. When one attains the state of dhyana through the mental practices explained in first chapter of yogā sutra, stage comes when a sadhak masters over passions and is liberated from the disturbances of mind. His consciousness develops a power of interpenetrating the minutest atom. The subtle particle here is the tanmatra 'परमाणुस्तन्मात्रम्',¹⁰ the commentators explains four types of any ,that of earth water, fire and air. The samkhya philosophy clearly denied paramāṇu but the modern yogā commentators succeeded in explaining it. Samkhya explained prakriti as the subtlest अलिङ्गात् परम् सूक्ष्मं न च अस्ति¹¹ The yoga philosophy thus compared tanmatra with vaisheshik philosophy.

NYĀYA

The 'aṅu' or 'paramāṅu' are the two words used to denote atom. The various Indian schools used the term 'aṅu' in sense of minutest particle. The Nyāya- Vaisheshik were the great supporters of the theory. The Nyāya school of philosophy was founded by Aksapāda Gautama. Additionally recognized as tarkaśāstra (the discipline of logical reasoning), hetuvidyā (the study of causes), and anvīkṣikī (the science of critical analysis), Nyāya philosophy encompasses various facets of inquiry and analysis. This philosophical tradition subscribes to the principles of atomistic pluralism and logical realism. According to Nyāya, atoms are the fundamental building blocks of matter, and the universe consists of multiple entities, both material and spiritual, making up its ultimate constituents.

Gautama, in his fourth chapter of Nyāyasutra explains paramāṅu by raising the question and further gives clear view to the minutest particle in his sutras, making avyay- avyayi as base, he mentions, श्रवयवावयविप्रसङ्गश्चैवमाप्रलयात् ||^{11,12} Avyay remains in all parts of avyay. Let's understand avyayi as tree and avyay as its branches. Now, if the division of the branches is done at such level that it cannot be further divided, Gautama here raises the question, the the branches are of tree itself, will we find the existence of avyayi at paramāṅu level and till it gets engrossed in its cause? This question will keep on arising and in end one will have to accept absence or shunya. Here the doubt arises that how can the origination takes out of shunya?

The next sutra by Gautama gives an appropriate answer, न प्रत्योऽसद्भावात्¹³ 'Pralay' means dissolution, but the paramāṅu never dissolutes because it is a cause(karana), the one that gets destroyed is karya (action, procedure) , like procedure of the atoms combining and forming the branches of tree. This concludes that, since 'abhava' 'shunya' does not take place. The paramāṅu are eternal, indivisible, they are themselves indistructible but their process of collision and disintegration is destroyed.¹⁴

VAISHESHIK

The word Vaisheshik comes from 'vishesh' meaning distinction. Maharishi Kanad developed his own philosophy which mainly deals with the atomic theory. The philosophy consists of ten chapters and three hundred and seventy aphorisms.¹⁵

The Vaisheshik considers diversity as the root cause of the universe. The philosophy extensively discusses categories and elucidates atomistic pluralism, wherein 'category' refers to 'padārtha'.¹⁶ Padarth generally means 'object' but in this system it means, पदस्य अर्थः पदार्थः॥ According to this 'पद' is understood as synonym of 'word' and the scholars described 'अर्थ' as ऋच्छतीन्द्रियाणि यं सोअर्थः, that is the one that can be perceived through senses, is arth. Therefore, padarth means "those things indicated by words, which the senses are capable of receiving." "Hence, from this standpoint, the entirety of the universe can be divided into two fundamental categories: existence (bhava) and non-existence (abhava)."¹⁷

As per this philosophy, there are seven fundamental categories called "padarth" According to this philosophical perspective, there exist seven primary categories known as "padartha." These include Substance (dravya), Quality (guna), Action (karma), Generality (samanya), Particularity (visesa), Inherence (samavaya), and Non-existence (abhava). The first four has objective existence (V. S. i.e. 2.7 in ibid) whereas samanya, visesa, samavaya can only be understood logically. (Sridhara, Nyāyakandali p. 19). The abhava was later added by the Vaisheshik commentators. In the Vaisheshika system, the primary entity is substance (dravya). It can be composite or simple. The composite are the one that can be seen or are materialistic and the simple are the one that are real, unchangeable and eternal. पृथिव्यापस्तेजो वायुराकाशं कालो दिगात्मा मन इति द्रव्याणि। (वैशेषिक सूत्र 1.1.5) Earth(prithvi), water(ap), fire(tejas), air(vayu), ether(akasa), time(kala), space(dik), soul(atmana) and mind(manasa). Vaisheshik darshan gives recognition to these substances as building blocks of world. The first five substance are material, the space(dik) and time(kala) are semi-material as they can be only experienced and has no physicality. The last two mind and soul are eternal.

Substance(simple) are nine

1. Earth(prithvi) – atomic and eternal, many, physical, produce composite
2. fire(tejas) – atomic and eternal, many, physical, produce composite
3. Water(ap) – atomic and eternal, many, physical, produce composite
4. Air(vayu) – atomic and eternal, many, physical, produce composite
5. Ether(akasa) – one, eternal, all pervading, physical
6. Space(dik) – one, eternal, all pervading
7. Time(kala) – one, eternal, all pervading
8. Mind(manasa) – atomic, many, eternal, physical
9. Soul(atman) – eternal, many, all pervading, spiritual substance

This chart here describes that how creation or an individual exists. One should understand that all the substances are eternal, it is so because they have their own individuality and are beyond creation and destruction. Anything that can be created or destroyed is the composite substance.

Paramāñu:- "In the Vaisheshika tradition, earth, water, fire, air, and mind are regarded as atomic and eternal among the nine substances. This viewpoint originates from Kanada's philosophy, which asserts the eternity of atoms due to their lack of a cause. While atoms themselves are not directly observable, their presence is deduced from their observable effects."

अणोर्महतश्चोपलब्ध्यनुपलब्धी नित्ये व्याख्याते ॥८॥ (V.S)

In the ordinary life atoms are not directly visible where as big things are visible. By this its commented earlier that the form is the cause for the visibility or invisibility.

In the Vaisheshika perspective, ether, space, time, and soul are considered non-atomic and omnipresent, hence eternal. According to Vaisheshikas, the gross objects in the universe are formed from the subtle elements, so subtle that they cannot be seen and can only be visualised, these are the atoms. Therefore, creation means combination of atoms. Gross objects consist of parts that are

interconnected with the whole through relationships such as inherence or conjunction. Thus, the Vaisheshikas does not believe in complete destruction of thing. नित्ये नित्यम् ॥19॥ The eternal exists in the eternal itself. Thus, defining the shape of the atom as नित्यं परिमण्डलम् ॥20॥ means the 'Paramāṇu' is eternal and spherical in shape. Since the atom is considered eternal, during the dissolution of the world, matter undergoes annihilation. At this juncture, the paramāṇu, the fundamental particles of the atom, can exist in two states—either absolute rest or in a state of motion.¹⁸

Combination of 'Aṅu' or atom

The atom cannot be produced or destroyed. But the atoms combine to form a substance. The conjunction of atom occurs in three ways: -

- Contact occurs when one object moves in relation to another without any involvement from additional objects.
- Both objects involved in the contact could be moving.
- Contact through physical contact.

For the atomic combination some energy is needed and the Vaisheshikas mention, अनेरुज्वलनं वायोस्तिर्यक् पवनमणूनां मन सञ्जाद्यं कर्मा दृष्ट कारितम् ॥ 13

The upward raising of fire (by invisible power of fire), the slanting of air (by invisible power of air) and the movement of atoms and mind (by infinite power), the first action is performed by the invisible power of supreme.

The four types of composite atoms exhibit qualitative distinctions. Each atom is unique and exists as an individual entity separate from the others. The finest atom shows the quality of subtle elements (touch, colour, taste and smell). They too contain velocity, number, distinctness etc. In addition to these fundamental qualities, atoms also possess secondary characteristics such as being spherical in shape, inert, and motionless unless acted upon by an unseen moral force. In contrast to the Vaisheshika school, the Greek atomism of Leucippus and Democritus recognized only quantitative differences in atoms and maintained their qualitative equality. If we look at the Greek school, atoms are ultimately the smallest possible pieces of gross matter. On the other hand, the Vaisheshika philosophy holds that the atoms, though material in substance, are completely devoid of all grossness, as "they had neither an inner nor an outer part." "We find that the Jains agree with the Vaisheshikas regarding the ultimate particles of the world as being partless, eternal, indivisible and imperceptible. According to Jain canonical literature, physical substance (pudgalāstikāya) is characterized by four qualities viz colour, taste, odour, and touch, possession of these qualities. "As mentioned earlier, the term 'pudgala' derives its name from the fact that it possesses the qualities of being fusionable and fissionable. The term 'pud' (purana) stands for fusion, and 'gal' (galana) signifies fission. In simpler terms, the processes of fusion and fission are inherent properties of the physical universe. The process of fusion is referred to as 'bandha,' which means integration, while the process of fission is known as 'bheda,' meaning disintegration. Here, the term 'process' (prakriya) is employed to distinguish it from the dynamic activity of motion (kriya)." The number of paramāṇus – ultimate atoms – combining together in a fusion process may vary from two to infinity. The objects formed by fusion of paramāṇus are called skandhas, i.e. aggregates or composite bodies. Two or more aggregates may also unite to form one larger object. Sometimes a few paramāṇus only may unite with an aggregate. In fission, aggregates break up and may result in – (a) smaller aggregates, (b) smaller aggregates and free paramāṇus. Sometimes a few paramāṇus only may separate from the main aggregate.¹⁹ Though the atomic combination is thoroughly explained by Jains, the Jainists believe that the subject of Indian (and non-Indian) philosophies has not been thoroughly addressed. It's noteworthy that when physicists discussed ancient atomistic theories, they often cited Democritus and Kanāda, the advocate of the Indian Vaiśeṣika school of philosophy. However, the significant contributions of Jain philosophy to the comprehension of the atom were largely disregarded or rarely acknowledged.

Democritus and Leucippus

The atomism theory in west emerged by Greek philosophers. Leucippus and Democritus were the first one to discuss this. The less is known about Leucippus and Democritus but the teachings were continued by Aristotle and Epicurus. They drew the clear line between spirit and matter, picturing the latter as being made up of “basic building blocks”. Only two different elements, the void and solid atom which are infinite in number are used to explain the entire universe, in accordance with the senses of motion and changes.²⁰

Democritus who was contemporary of Socrates and who flourished about 420 BC; took the final step towards the concept of atom, the smallest, indivisible unit of matter. The atom in his theory is considered eternal and indestructible, yet it is assigned a finite size. The atom of Democritus were purely passive and intrinsically dead particles moving in the void. They were all of the same substance but had different sizes and shapes. Each atom was eternally unchangeing, impenetrable and indivisible, because it contained no void. Between atom there was empty space or void through which they collide with each other and occupy different positions and may combine with each other according to some natural laws. Democritus is attributed with the statement: "Things merely seem to have color, they merely appear to be sweet or bitter. Only atoms and empty space possess true existence. The atoms of Democritus were associated with the external force that bring some motion in them, they can be understood as the supreme power as the term used by Vaisheshik commentators. These atoms were assumed to be of spiritual origin and different from matter. The basis ideas of atomic theory were followed by Greek philosophers. Epicurus (342-270 BC) followed Democritus in believing that the world consisted of atoms and void, but he did not believe as Democritus did, that atoms were completely controlled by natural laws.

Scientific theory: - The origination of scientific theories came forward after atom of Democritus. Dalton atomic theory was the first one and is related to Democritus's theory. Dalton's modern atomic theory, like the ancient theory proposed by Democritus, elucidates the nature of matter in terms of atoms. Dalton states that “Atoms are imperceptible to the unaided eye and cannot be either created or destroyed. Furthermore, all atoms of the same chemical element are identical, and compounds are formed through the combination of various chemical elements in fixed ratios.” This theory is given more importance due to refined studies and experimentation. The several other theories than came forward in defining the microscopic view of atom. When considering polymers and composites through the lens of Western atomism, we can understand them as aggregates of molecules and atoms. Polymers consist of long chains of repeating monomers, while composites are materials composed of two or more distinct phases, such as fibers embedded in a matrix. Within this framework, the properties of polymers and composites can be explained by the arrangement, bonding, and interactions of their constituent atoms and molecules^{20,21}.

CONCLUSION

The universe consists of several things, from the biggest to the minute, from known to unknown and from visible to invisible. Atom is mostly understood on a scientific basis but science is still unable to answer from where the energy comes from question here the philosophical theory comes one step forward and explains in terms of spirituality. The Nyāya-Vaisheshika were the great supporters of atomism. The Hinayana B Buddhist too supported atomism. Vedanta did not accept the atomism. The Samkhya and yogā criticized the theory of atom and gave similar importance to prakriti and it's tanmatras later the scholars could explain atomism in Samkhya yogā by comparing paramāñu and tanmatra. Thus, we find that these philosophies showed their interest in atom but a clear view was not given to them. The Jainas explained atom thoroughly in their text and Hinnayana Buddhist sect too accepted but their religious matter forbidded them to give much importance on the matters concerned atom. The Nyāya-Vaisheshika have not accepted religious matter and was mostly related to scientific theory. These philosophical theories emerged many years back in yogāic period, when sufficient study was done on them, it is found that many theories emerged keeping them as a base. Most traditions

recognize the intricate arrangements of atoms and molecules within polymers, contributing to the understanding of material properties and the nature of the universe.

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