

Trends in the Use of Household Water Purifiers with Activated Carbon Components by Consumers in Quang Ninh

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Abstract

Water is a basic human need, and it plays an important role in maintaining a good life and health. The water pollution and urbanization in Quang Ninh province have promoted the household's demand for water purifiers, in which activated carbon often serves as an essential raw filter core. This study analyzes the factors that measure the consuming water purifiers with activated charcoal components among Quang Ninh consumers regarding the factors: trends on time, frequency, and payment levels; assessment of the benefits of the water purifier with activated charcoal; factors affecting the users' choices; and the Quang Ninh consumers' concerns of water cleaners with active carbon components. These are useful information that helps companies manufacturing and supplying water purifiers to capture real needs, thus offering suitable, efficient, and cost-saving products to consumers.

Keywords: trends, water purifiers, activated carbon, activated charcoal, consumers, Quang Ninh

1. Introduction

Water is a basic human need, and it plays an important role in maintaining a good life and health. However, water quality is not always guaranteed to be clean, especially in countries with incomplete water systems like Vietnam. Therefore, the demand for household water purifiers has become an essential trend to protect consumers' health from harmful chemicals in water sources. Among today's water purification technologies, water purifiers with activated carbon components are receiving considerable attention due to their ability to effectively remove pollutants.

Activated charcoal has a large surface area and high absorption capacity, helping to effectively removing impurities, chemicals, and toxic substances from water. With strong absorption of organic compounds, heavy metal ions, chlorine residues, and pesticides, activated charcoal improves water quality and makes water safer and cleaner for daily use. Water purifiers with activated carbon components not only eliminate impurities but also deodorize and improve the taste of the water. This is especially vital in areas where the water is high in chlorine and other chemicals. Moreover, using a water purifier minimizes the risk of contracting illnesses associated with contaminated water, protecting the health of family members.

So, in the filter core of current household water purifier, activated charcoal often serves as an indispensable coarse filter core. With increasing water pollution, activated charcoal plays an important role in generation clean and safe water. Quang Ninh, with its progressively developing canal system and urbanization, need to improve the water quality of the local population. Nielsen's report, (2023) on clean water consumption habits and trends in Vietnam shows that people are increasingly concerned about water quality and are willing to invest in water purification equipment to protect their health. Water from rivers, lakes, and even the tap water supplied to households can contain pollutants such as heavy metals, chemicals, and pathogenic bacteria. To cope with this problem, the demand for household water purifiers, especially those with active charcoal components, is rising considerably.

This article will analyze factors measuring the trends of using household water purifiers with activated charcoal components among consumers in Quang Ninh through the following contents: trends in time,

frequency, and payment levels; assessment of the benefits of water purifiers; factors affecting users' choices; and users' concerns about activated carbon components. Understanding the trends of using household water purifiers with activated charcoal components by people in Quang Ninh is essential because it helps enterprises producing and supplying water purifiers to capture the real demand, thus offering suitable, efficient, and cost-saving products to consumers.

2. Theoretical basis

2.1. Some concepts

Activated carbon/Activated charcoal

Activated charcoal has been discovered and used as a liquid absorber since the 18th century and was first used to absorb gas in 1773. According to the 37th JECFA (1990), published in FNP 52 (1992), the concept of activated charcoal is: "A solid, porous, carbonaceous material prepared by carbonizing and activating organic substances. The raw materials, which include sawdust, peat, lignite, coal, cellulose residues, coconut shells, petroleum coke, etc., may be carbonized and activated at high temperature with or without the addition of inorganic salts in a stream of activating gases such as steam or carbon dioxide. Alternatively, carbonaceous matter may be treated with a chemical activating agent such as phosphoric acid or zinc chloride and the mixture carbonized at an elevated temperature, followed by removal of the chemical activating agent by water washing".

Activated charcoal is produced by the combustion of carbon-rich fuels such as wood, coal, coconut, and bamboo at high temperatures ranging from 600 to 900 degrees C in a low-oxygen environment. (Sadashiv Bubanale & M Shivashankar, 2017). The basic characteristics of activated charcoal are as follows:

- Color: black (Olson 2010, EFSA 2011)
- Type: There are many types of activated charcoal. However, the most popular ones are usually powdered activated charcoal (PAC) and particulate carbon. (GAC). (Gareth Neighbour, (2013)
- Physical properties: Activated charcoal has a spherical structure, as opposed to the relatively less developed sphericity observed in solid lead carbon which is usually sold in powder form (Gareth Neighbour, 2013).
 - Processing method: The processing method of activated charcoal consists of physical and chemical methods. According to the physical method, the raw material is chemically activated at high temperatures to produce active charcoal, including coconut, fruit, stone, hardwood, and coal (Anna Vil'en. et al, 2022). The significant advantage of chemical activation over physical activation is that the process can be performed even at lower temperatures, and the efficiency obtained from chemical activity tends to be better because coal can be avoided from burning (Muthaian., J. R. & Clastin., I. A., 2022)
 - Surface area: Activation of coal significantly increases the surface area, including the creation of multiple micropores, contributing to the creation of a surface area ranging from 800 to 3,500 m²/g). (Olson 2010, EFSA 2011)
 - Absorption capacity: Activated charcoal is known to be highly absorbent due to increased surface area (Olson 2010, EFSA 2011). The high absorption capacity of activated charcoal makes it useful for achromatism and water filtration applications (USDA, 2021) or applications in air filtration, such as respirator masks (Gareth Neighbour, 2013).

With these physical properties, activated charcoal will remain the pillar of the carbon world and the key material in the creation of materials and extending applications in many areas of life and manufacturing. One of the most common applications of activated charcoal is being household water purifier with the main purpose of removing toxic chemicals and impurities in the water.

Household water purifier:

A household water purifiers' functions is to reduce solubility, dimness and microorganisms... in the water by using a filter environment or reverse osmosis filter (RO filter) to supply water for household purposes.

"A household water purifier is a type of machine that have functions to reduce solubility, dimness, microorganisms... in the water by using a filter environment or a reverse osmosis filter (RO filter) to supply water for drinking purposes. Household water purifier including the type of drinking water supplier that is placed in public such as airports, stations, supermarkets, schools..." (Section 1 National Standard TCVN 11978:2017)

Classification of household water purifier (Section 4 National Standard TCVN 11978:2017):

(1) Continuous type water purifier: is a water purifier functions by connecting to a tap through which the filtered water is supplied continuously without being stored in a compartment or container

(2) Batch operation type water purifier (BAT): is a filter machine that needs to be watered each time, the filtered water obtained is stored in a tap or a container with a tap for use.

Types of activated charcoal used in household water purifiers

For household water purifiers, activated charcoal will be used to form a separate filter core, combined with other filter cores to provide the best water purification efficiency. (Karofivietnam.vn, 2021). According to activatedcarbon.vn, (2023), activated charcoal applied in water purifier can be divided into three types:

Type 1: Activated charcoal in powder form. Powdered activated charcoal is used the most commonly to filter odors, and absorb dirt as well as water-soluble compounds. Due to its volatile characteristics, this activated coal is mostly used in industrial filtering systems.

Type 2: Activated charcoal in particle-shaped compound small particles, with greater strength. This is a commonly used component in household water purifier products. All products of RO or Nano technology filters have a core filtering application of this material. Activated charcoal in particulate form is compressed by the manufacturer in a filter cup to increase the surface exposure area, as a result, helps increase the water purification productivity of this material.

Type 3: Activated charcoal in block-shaped. This is the best-activated coal that has ever been widely used. The dirt, the toxins, the colors, and the smells are absorbed effectively after filtering through this type of material. Activated charcoal has a large surface area, good effect, long life as well as high usage value.

In modern household water purifiers, the active coal filter core is designed as a filter layer, which is combined with cotton fibers pressed into blocks. Therefore, when replacing activated charcoal, it usually replaces the entire filter core.

2.2. The advantage of a water purifier that contains activated carbon component

According to the U.S. Environmental Protection Agency (EPA), activated charcoal is an effective solution to remove all 32 organic pollutants, including THM's, 12 herbicides, and 14 listed pesticides, including nitrates, glyphosate, etc. (1980) which helps ensure the health safety of users. In this case, with contaminated water, activated charcoal is often used as the primary method before other purification processes, or as a third last step to improve water quality after purifying. (Joana M. Dias et al, 2007).

Some of the major effects of activated charcoal in household water purifiers are:

(i) Removing impurities and pollutants:

- Activated charcoal has strong absorption capabilities, helping to remove organic and inorganic impurities in the water. By removing impurities and dirt, activated charcoal helps purify the water. (Changjia Jiang et al, 2019)

- Bacterial prevention and removal: Activated charcoal is capable of inhibiting, preventing, and removing harmful bacteria in water, ensuring safe water for health.
Absorbs heavy metals and toxic ions: Activated charcoal removes residual heavy metal ions such as lead and mercury, minimizing the risk of harm to the body.

(ii) Deodorizing and improving water taste: Activated charcoal dissolves the smell and other unpleasant odors from the water, improving the taste of the water.

(iii) Improve water filtration productivity as well as increase the lifetime and efficiency of the filtration system.

- Large exposure surface area of activated charcoal increases absorption capabilities, supports the filtering system, and improves water filtration productivity.

- Increase the lifetime and efficiency of the filter system: Using powder, particle, or block form of activated coal in household water filters could prolong the lifespan and increase filtration efficiency.

2.3. Factors that measure the trend of using household water purifiers with activated charcoal components

It can be seen that water is an indispensable human demand and that water quality is a consumers' concern, especially in countries where the quality of the water supply is an unresolved problem. Trends in using water purifiers with activated charcoal components are researched, and analyzed through some contents:

- Trends in time, frequency, and payment levels among people in Quang Ninh regarding the use of household water purifiers with activated charcoal components. The time and frequency factors of using

household water purifiers reflect people's interest in drinking water quality as well as the convenience and effectiveness of getting the water.

- Assessment of Quang Ninh residents (survey participants) on the benefits of household water purifiers with activated charcoal components (according to the benefits groups in section 2.2).

- What factors influence the consumers' choices? The theory of consumer behavior suggests that factors affecting consumer choices often include:

(i) Product quality. Product quality is a leading factor impacting consumers' decision to buy water purifier, Kotler, P., & Keller, K. L. (2016). Products of clear origin, reputable brands, and certified quality from prestigious agencies such as ISO, NSF are generally more preferred. Advanced features and technologies such as the ability to remove a wide range of pollutants, fast water purification, and energy-efficient technology, are also factors that reflect product quality. Products with superior features and modern technology are often more favored.

(ii) Price: The price of the product is also an important factor. Consumers often compare prices among different brands before making a decision. (Schiffman, L. G., & Kanuk, L. L., 2009). Products with reasonable and affordable price tend to be more attractive.

(iii) After-sales service. According to Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2013), after-sales services, including warranty policies, technical support, and maintenance services, also significantly influence consumer decisions. Brands that provide good, fast, and efficient after-sales service often get customers' trust and choice.

- Regarding the activated charcoal component in the water purifier, what are the remaining concerns of the consumers during the using process? Regarding concerns about whether the quality of activated charcoal filtration is harmful to health, according to the EPA, the available information on water treatment with granular activated carbon (GAC) does not provide any evidence that the process brings about harmful health effects under proper operating conditions. Although more in-depth research is needed to assess the harmful health effects of GACs, in areas where contaminated water sources pose a potential risk to consumer health, the potential risks arising from GAC use should not prevent people from using activated charcoal in water filtration. (NIH, 1980). According to activatedcarbon.vn, (2023), the use of activated charcoal to filter water do mostly no harm to human health. However, the problem lies in the frequency of filter core change. (Karofi.com, 2020). Depending on the level of water pollution, the frequency of filter core change may vary but it should be changed every once in less than a year. If left longer, the quality of the filtered water is not guaranteed to be good for the human body, possibly even more polluted than if the filter core was not used. (Karofi.com, 2020). If in the case of all the activated charcoal filters are filled with impurities, these pollutants can flow back into the water and re-contaminate the water. Other users' concerns include the problem of expense, delivery costs, and the cost of replacing the active charcoal filter core.

3. Research Methods

To find out the trends in using household water purifiers with active carbon components among consumers in Quang Ninh, the team used two main methods of research:

- Desk research: review online documents about activated charcoal, water purifier, components used in household water purifiers, the benefits of activated charcoal water purifier for water quality and filtering productivity. The team researched water sources and the status of the drinking water in Quang Ninh

- Sociological survey: Using methodology to study the reactions of target consumers in Quang Ninh through Google form surveys. The data collection method of the team is based on two methods: the convenient sampling method and the "snowball" method: searching for the next audience based on suggestions of the subjects involved in the survey. The survey was built on Google Drive, conducted a trial interview with five consumers who used water purifiers with active coal components and sent the survey link <https://forms.gle/JXe1Z1F43Z2MzHBCA> to consumers in Quang Ninh through social networking channels such as Zalo, Gmail, Facebook. The total votes collected was 255. Among these, 32 voted not to use a household water purifier, the remaining 223 votes was used to assess the trend of using activated-carbon water purifiers. Data collected is synthesized, calculated, and reflected in tables, data collected are aggregated and analyzed using Excel software, followed by analyzing and demonstrating research problems.

4. Results of the study

4.1. General introduction of Quang Ninh province and the state of drinking water in Quang Ninh

Quang Ninh is a coastal province in the northeast region of Vietnam. According to the economic development plan, Quang Ninh is a key economic area in both the North and the North Central Coast. (Wikipedia, 2024). This is the main coal-mining province of Vietnam due to its rich mineral resources with 209 mines and mining points of 36 types of minerals investigated, explored, and evaluated. Quang Ninh's coal reserves are estimated at 8.8 billion tons, with about 3.6 billion tons at a depth of less than 300 meters, being home to the largest and best-quality coal reserve in Southeast Asia, providing predominantly durable and high-carbon anthracite coal. (Special.nhandan.vn, 2023).

Quang Ninh has an area of more than 12,000 square kilometers, of which 6,206,9 square kilometers are land, 80% of the land area is mountainous, including more than 2,000 limestone islands on the sea. (Special.nhandan.vn, 2023). Therefore, Quang Ninh varies in the type of terrain including plains, mountains, coasts...

The province has 13 district-level administrative divisions consisting of 4 cities (Ha Long, Uong Bi, Cam Pha, Mong Cai), 2 communes (Quang Yen and Dong Trieu,) and 7 districts (including 2 island counties), with a total of 177 communes, wards, towns. According to information from the Quang Ninh Web Portal, as of June 13, 2023, Quang Ninh has a population of 1,413,452 people. (quangninh.gov.vn, 2023). With this population size, the total water use demand of the province is 431.28 million m³/year. Meanwhile, according to the calculations of the specialized agencies, at the same rate of growth as in previous years, it is expected that by 2025, Quang Ninh will be lacking more than one million cubic meters of water, and more than 2.6 million cubic meters of water in 2030. Quang Ninh's goal is that by 2025, the use of clean water by urban residents in Quang Ninh will be more than 98%, and the usage of sanitized water by rural residents will be 100%, of which 80% will use clean water.

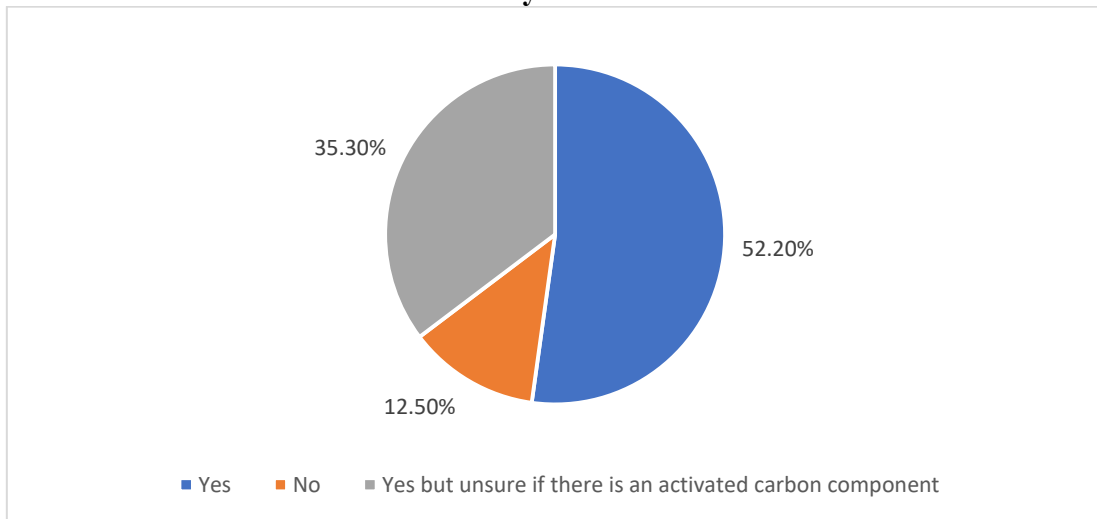
The water supplies to the population's higher demands are mainly from natural water sources, rivers, and reservoirs. In Quang Ninh, there are 67 rivers and streams that are over 10km long. Among these, there are six rivers and streams belong to the Grand River Basin, 29 rivers of the Independent Interprovincial Basin and 32 rivers that are Independent Inner-Provincial Rivers. There are also 176 saltwater lakes with a total exploitable capacity of more than 396 million m³/year for production and living (Hoach, P., 2024). Reservoirs play an important role in stabilizing water supplies for livelihoods, industries and crops. The potential of groundwater is relatively rich, but the capacity to exploit and use it to serve socio-economic development is also facing many difficulties due to the geographical characteristics of the fragmented topography, the distribution of aquifers is mainly within fractures and tectonic fault zones. (Special.nhandan.vn, 2023).

Currently, the water used is raw water. It is necessary to review, adjust, and supplement the water supply system to ensure compliance with provincial planning; gradually replace the stable raw water supplies from reservoirs, dams and drainage systems; research, and supplement local source solutions to serve water supply in the event of water problems, natural disasters such as drought, water shortages, salt infiltration, floods, swamps (People's Committee of Quang Ninh, 2023).

4.2. Description of the survey subjects

Of the 255 polls received, 133 responded "Yes" to using activated carbon water purifiers (52.2%), 32 responded "No" (12.5%), and 90 (35.3%) responded, "Yes but unsure if there is an activated carbon component"

Figure 1: Rate of use of water purifiers with activated charcoal components of the subjects surveyed



Source: Survey result

With 32 people who didn't use a household water purifier that contained activated charcoal components, the team surveyed why they did not use it. The survey noted that the reasons for not using the water purifier were "consumption of bottled water", "financial ineligibility" and "distrust in the quality of the water purifier".

The 223 votes in the other two groups were included in the trend survey. As for the sex of the participants, there were 119 males (53.4%), 100 females (44.8%), and four who did not want to specify (1,8%).

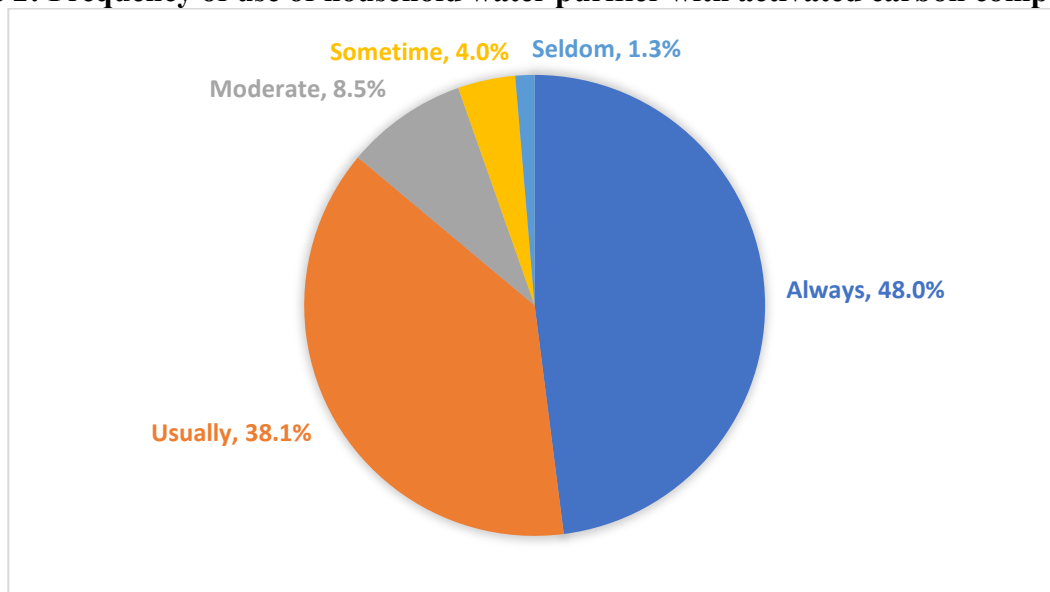
4.3. Survey results

The trend of water purifiers usage with active charcoal components by the people of Quang Ninh was reviewed under various angles.

As for the initial time of using water purifiers with the active coal components, 176 people (79%) used it a long time ago (before 2023) and 47 people (21%) used it recently (2023 to now)

In terms of the usage frequency of water purifiers with activated charcoal components, since it serves the basic needs of the household, the frequencies of use are "always" and "usually" (48% and 38.1% respectively).

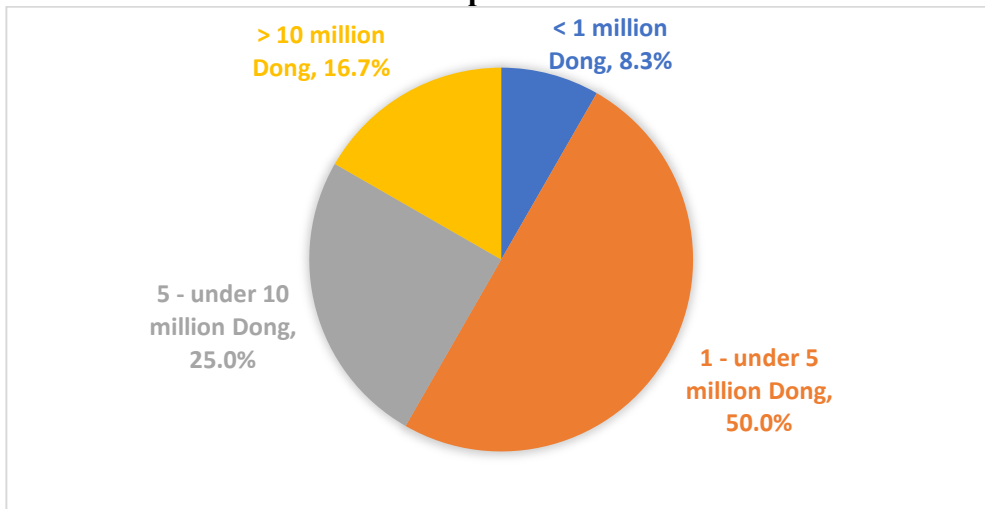
Figure 2: Frequency of use of household water purifier with activated carbon components



Source: Survey result

The survey was also conducted to obtain results on the amount of money spent on household water purifiers by Quang Ninh consumers, as shown in Figure 3.

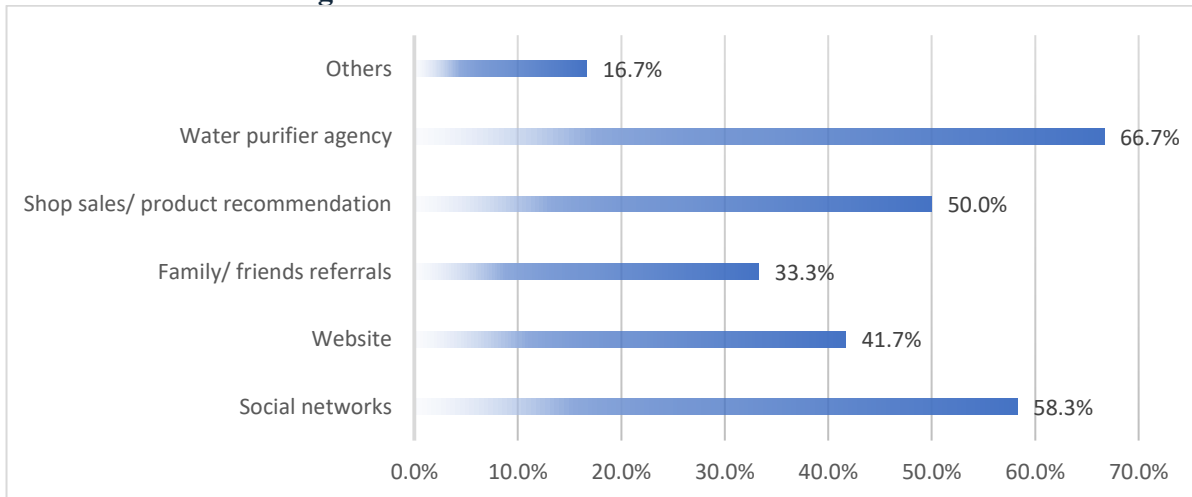
Figure 3: The amount spent on purchasing a household water purifier with activated charcoal components



Source: Survey results

Sources for Quang Ninh consumers to find information about water purifiers with activated charcoal components are the official website of the brand; Water purifier agency; Shop sales/product recommendations; Friends, and family references; Social networks and other channels. Checkbox survey questions (respondents can selected multiple options) returned the results in Figure 4:

Figure 4: Consumer's channels of information

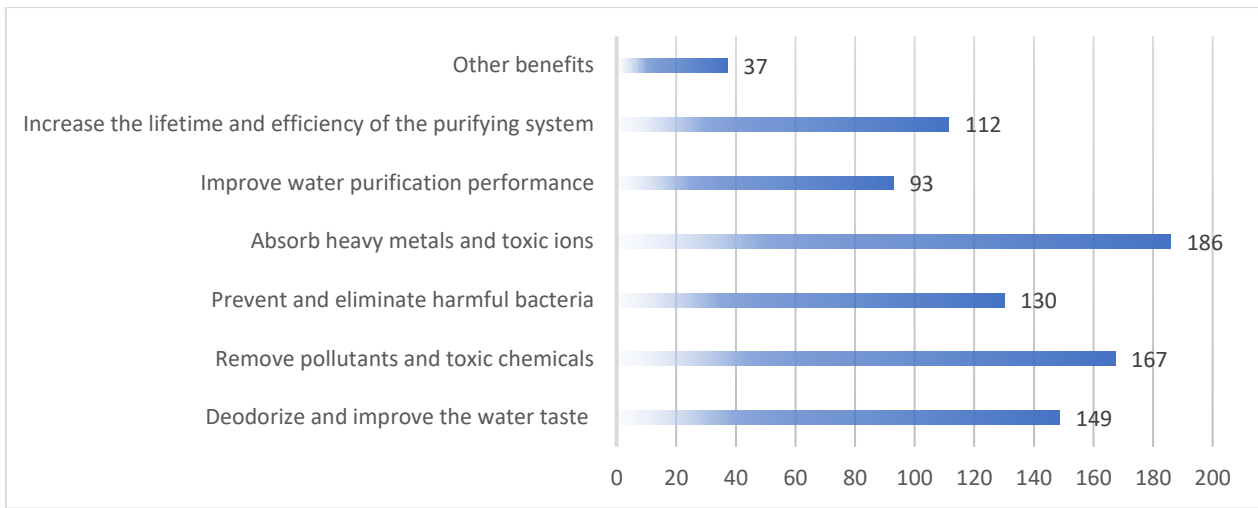


Source: Survey results

Accordingly, the most popular sources of information are water purifier dealers 66.7% (with 149 votes); followed by social networks 58.3% (with 130 votes); stores selling/showcasing products 50% (with 111 votes); websites 41.7% (with 93 votes); friends, and family referrals 33% and other channels 16.7%. This result suggests that, since water purifiers required installation, maintenance, and replacement of the filter core later on, users tend to look for information and use services at water purifier dealers. In addition, social media channels and websites are very effective.

Regarding the benefits of a water purifier with activated carbon component, the group reduced the aforementioned three groups of benefits in the theoretical section to seven specific benefits in Figure 5.

Figure 5: Benefits of water purifier with activated carbon components

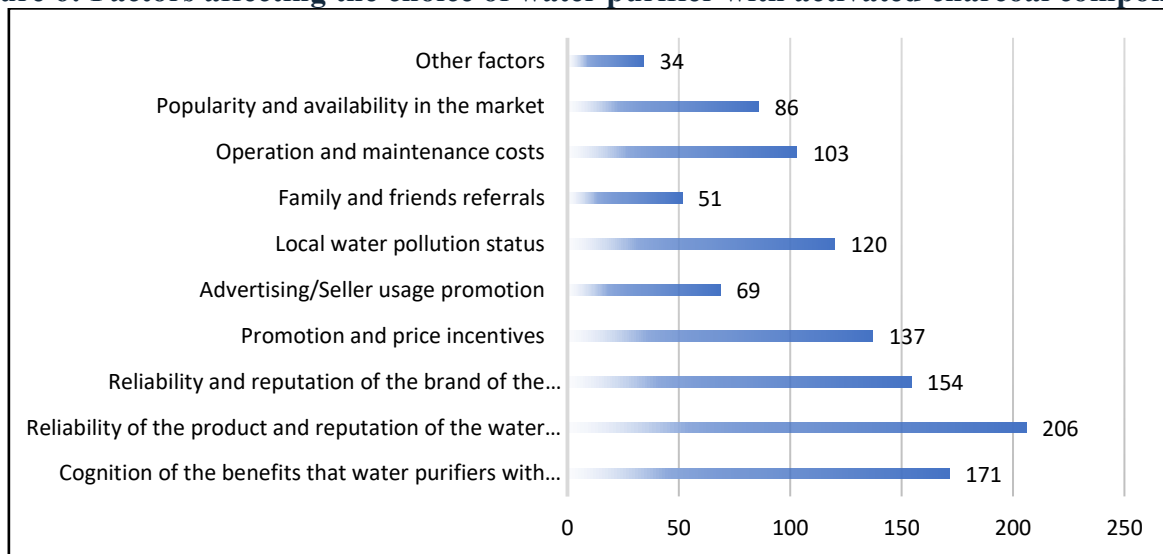


Source: Survey results

The result showed that the biggest benefit was "Absorb heavy metals and toxic ions" with 186 votes (83.3%). The other benefits were "Eliminate pollutants and toxic chemicals" with 167 votes (75%), "Deodorize and improve the flavor of water" with 149 votes (66.7%); "Improve water purification performance" with 93 votes (41.7%) and "Enhance the lifetime and efficiency of the filtration system" with 112 votes (50%).

On the factors affecting the use of water purifiers with activated charcoal components by the people of Quang Ninh, see Figure 6.

Figure 6: Factors affecting the choice of water purifier with activated charcoal components



Source: Survey results

According to the results of the survey, "Reliability of the product and reputation of the water purifier brand" received 206 votes (92.3%) and "Cognition of the benefits that water purifiers with activated carbon components bring" received 171 votes (76.9%) "Reliability and reputation of the brand of the seller/distributor" received 154 votes (69.2%) are the three factors that most influence the choice of water purifier with activated carbon components of the people of Quang Ninh. Other factors with average level of impact are "Promotion and price incentives" (61.5%), "Local water pollution" (53.8%), and "Operation and maintenance costs" (46.2%). The least impactful factors with a selection percentage of less than 30% included: "Advertising/Seller usage promotion", "Family and friends' referrals" and "Other factors".

5. Discussion

Consumers in Quang Ninh are increasingly aware of the importance of clean water. Therefore, they tend to choose water purifier products with activated carbon components. Such products are highly appreciated for their efficient filtering and reasonable price. Households, especially those with young children and elderly,

often prefer water purifiers to ensure their health. Some trends from the results of the study are consistent with previously drawn conclusions, including:

- Time and frequency of use: Survey studies show that households use water purifiers with a daily rate of use (48% very frequently and 38.1% regularly). This reflects people's high interest in drinking water's quality, and also the convenience and efficiency of water purifiers in providing clean water. However, 33.3% of Quang Ninh water purifier users are unsure whether the filter core contains activated charcoal, indicating the need to enhance the promotion of local water purifiers businesses and dealers.

- Budget for water purifiers: The consumer's payments for water purifiers with activated charcoal components range from 1 million to over 10 million dong, of which 50% range from 1 to less than 5 million depending on the capacity and brand of the product. High-income households are often willing to pay more for higher-end products to guarantee better water quality. The survey also revealed that this is generally considered reasonable compared to the benefits of water purifiers, especially in the context of increasingly serious water pollution issues. In addition, the activated charcoal filter core is usually a raw filter core, which does not have a big impact on the cost of the water purifier, which helps consumers save money since the price of the activated charcoal filter is relatively cheap.

- The main information channel that Quang Ninh consumers use to learn about the components and the mechanism of the device are water purifier agencies. They are the last channels with access to users, and it is easy to exchange and provide information there. In particular, the water purifier needs to go through the installation process, so having direct contact with dealer will facilitate the communication process about the use of the household water purifiers and the components of the filter core.

In addition, the results show that users often learn information through multiple channels. There are two main sources: 1) directly through water purifier agencies (66.7%) stores, product recommendations (50%) and 2) through online channels including: social networks (58.3%) and websites (41.7%). Despite the on-going trend of digitalization, most of the survey participants still get the information through the dealer's source due to the issues of installation, warranty, and replacement of filters in the process of use.

- Benefits of a household water purifier with activated carbon components: Activated carbon is capable of absorbing organic substances, chemicals, and other impurities in the water, even the heavy metal ions that are left in water due to its hollow structure and large surface area of exposure. All of these superior advantages are also an explanation to why in modern water purifiers, from household to high-power water purifiers, activated charcoal filters are essential. It treats raw water, ensuring that water qualifies for deeper purification and osmosis. Furthermore, activated charcoal is safe, unharmed to health because it is made from materials such as wood, coconut shells, bamboo trees without toxic chemicals. As a result, activated charcoal significantly improves the quality of drinking water: cleaner, tastier than unfiltered water. The activated charcoal component also enhances the water purifiers' performance and increases the life of the machine.

- When using a water purifier, most consumers are interested in the benefits that the product brings. The results of the survey showed that the main factor influencing the trend to use water purifiers with activated carbon components is the benefit toward water quality. In addition, several other factors such as water pollution levels; advice from friends and relatives; and advertisements from water purifier dealers also had an impact on the consumption trend of this product in Quang Ninh.

However, when using a water purifier with activated carbon components, Quang Ninh consumers who participated in the survey also weighed their concerns when using the product. Those are concerns about the residues of activated charcoal in the water component, the cost, the unknown origin, the frequency of the filter core replacement, etc., that pose several challenges to the manufacturing enterprise that the agency distributes. First is the expense, because not every family can afford to invest in high-quality water purifiers. It is necessary to promote that the activated charcoal in the household water purifier in the raw filter core has low price and does not contribute much to the overall expense of the water purifier. Regarding the maintenance and replacement of the filter core, users need detailed instructions on how to use and maintain the equipment to ensure long-term effective water filtration. Consumers need to monitor and replace coal on a regular basis to avoid saturation of contaminants. The saturation time of charcoal is usually between six and nine months, depending on the contamination level of the water source.

Thus, the activated charcoal filter core warrants many benefits, while being cheap, but there are still concerns of users about the safety and operation mechanism of activated coal in water filtration. The research team suggests that the water purifier enterprises continuously research to develop new products,

and improve water purification technology to meet the increasing demand of consumers. Factors that influence the benefits of activated coal such as filter core replacement time (depending on the level of contamination of the input water source), the water temperature needs to be fully interpreted to the customer. In view of these trends, the team proposed a few solutions to optimize the effects of household water purifiers with activated carbon components in Quang Ninh.

(i) For enterprises that manufacture and distribute water purifiers

- Water purifier companies and distributors need to diversify promotion channels. First is to improve the efficiency of traditional channels by leveraging a system of agencies, installations, replacement, and warranty. These are effective channels to reach and provide detailed, direct information to local customers. Besides, online platforms need to be expanded following the trend of digitalization. Official websites need a variety of information channels on online platforms such as websites and social networks, providing video tutorials, detailed descriptions on the benefits and how to use water purifiers, especially activated charcoal filters.

- The household water purifier business needs to boost its communications, ensuring that information about products, water purification technology, and components such as activated charcoal is transferred clearly and thoroughly to consumers. This communicates the benefits of using clean water and how to choose, use efficient water purifiers to community, especially emphasizing the effectiveness of water purifier with active coal filter core in improving water quality and health.

- Improved filter core replacement reminder process: With the activated charcoal filter core and operating process, the distributor needs to have a process to remind users of replacing each type of filter core based on the frequency of use of the activated carbon filter core "The use of water filter activated charcoal will be effective from 6 to 9 months depending on the level of contamination of the water source" to optimize the effect of the activated charcoal filter on water quality and user health.

(ii) For consumers:

- Increase awareness about the benefits and use of water purifiers by actively learning about water purifier and their components, especially the activated charcoal filter core, to select the product that suits the needs and conditions of the household. The sources can be reputable agencies, official manufacturer websites, and reliable online media channels for users to get a full and accurate view of the product.

- Pay attention to maintenance and periodic replacement of the filter core: Consumers need to pay attention to the replacement time of the filtering core to ensure efficient water filtration and maintain clean water quality. Users must follow the instructions of the manufacturer.

- Handling concerns about residues and product origin: Select products of clear origin and from reputable manufacturers to ensure quality and safety. Moreover, active water quality testing after filtration eliminates concerns about product quality and allows for early detection of problems, ensuring that drinking water is clean and safe.

6. Conclusion

By analyzing trends in the use of household water purifiers with activated carbon components by consumers in Quang Ninh, it can be observed that this is a product with the interest of consumers. Product quality, price, and health impact are the main factors that influence consumer purchasing decisions. The results showed that the trend to use water purifiers with activated charcoal components stopped at being a bonus component from the manufacturer. Despite appreciating the contribution of the activated charcoal components to the reduction of the harmful factors to human health from domestic water sources, the specifics of how activated charcoal works, why it's needed in water purifiers, and how to use it properly are not being focused enough. Besides, there are some concerns about long-term filtering efficiency, safety, and hygiene, as well as the environmental impact of disposed filters. To maintain and develop the market, manufacturers need to continue to improve their technology, improve the quality of their products and services, as well as provide clear information and support to consumers during their use of the product.

Based on the above trend analysis, the article makes two proposals: (i) for manufacturers and distributors and (ii) for consumers. Future research could be more focused on each district in Quang Ninh according to the level of water pollution; or more detailed research on each series, each group of technology of water purifier. In terms of research methodology, further studies can investigate users' behavior and analyze factors that influence the users' intention or influence the users' decision to choose water purifier with activated charcoal components.

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