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The Analysis of Gravity on Tourism Resource of Shijiazhuang with Anion, Hebei

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Abstract

This paper analyzes the decisive factor of The Shijiazhuang coastal economic zone's tourist resource from the perspective of the actual data by adopting Gravity model; meanwhile, presents an overall aspect of Shijiazhuang city, its current development of the tourism industry, and the advantages and characteristics as well. Further proposal is also produced to contribute to the tourist development based on the analysis of the model data.

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Keywords: Gravity model; Small molecules of water; air anion; tourism;

1. Brief Introduction of Shijiazhuang

1.1. General Information of Shijiazhuang

Shijiazhuang city—the provincial capital of Hebei province, is the center of politics, economy and culture. It is an emerging rapidly developing comprehensive central city.

Located in middle and south Hebei, Shijiazhuang is within the Bohai ring. The coordinates of Shijiazhuang is 37°27'N to 38°47'N and 113°30'E to 115°20'E. Shijiazhuang bounded on the north by Baoding, on the

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south by Xiangtan, on the west by Shanxi, and on the east by Hengshui. It is 283 kilometers away from Beijing.

Shijiazhuang is an excellent tourism city. It has a long history, a splendid culture, beautiful mountains and rivers. It has rich tourism resources, for example, Xibaipo, Zhangshiyan, Wuyuezhai, Mount Canyon, Tianshan Sea World and so on.

2. The Gravity Model Analysis of the Potential Contribution to the Tourist Market of Shijiazhuang

2.1. Brief Introduction of the Tourism Gravity Model

The fundamental idea of the tourist gravity model referring to the trade gravity model derives from the Law of Universal Gravitation. The Law of Universal Gravitation points out that mutual gravity between two objects is in correlation to the qualities of two objects, and in inverse ratio to the distance between the two objects. The trade gravity model guided by the Law of Universal Gravitation is a theoretical hypothesis which is established by geographers, sociologists and economists in order to explain and anticipate the way in which people interact each others in the economic, social and political fields in geography space. The introduction of the gravity model can be traced back to Garey (1858) whose book *The Fundamental of Social Sciences* explains the social phenomena making use of the Law of Universal Gravitation. Geographers and economists have introduced the gravity model into the theoretical analysis and the experience test in large scale since 1940s. Tingbergen (1962) established the trade gravity model in the study of international trade in order to explain the asymmetry of trade flow (namely the proportion of trade amount in GNP of the large countries is smaller than the proportion of the small countries) in the world. The trade gravity model points out that the bilateral trade amount between two countries or regions is in correlation with the economic amount of two countries or regions, and inverse ratio with the distance between two countries or regions. Economists often use the similar trade gravity model to explain the decisive problems about the flow and direction of the trade in one department.

In practical application, we can make use of the gravity model to study the attraction of one tourist city to other surrounding cities, and quantify the potential contribution degree of the surrounding cities to the tourist city, and figure out the shares in theory which those cities take up in the tourism market of the tourism city.

2.2. Figuring out the Region Share of the Surrounding Cities in the Tourist Market of Shijiazhuang by Gravity Model

The attraction of one tourism city to visitors from the surrounding cities is in correlation to the population, average per capita GDP, GDP and average per capita yearly income of the target city, and in inverse ratio to the distance between two cities. We select some typical cities in the distance and the scale to compare.

So we can show the gravity index F with the formula: $F_i = M_i M_j / d_{ij}^2$ and the shares which the target city takes up W with the formula: $W_i = F_i / \sum F_i$, in which M_i and M_j are the characteristic values such as the population and GDP, and d_{ij} are the distance between I and J .

2.2.1. Establishing the Gravity Model According to the Population as the Main Factor

The personnel intercourse of two cities is in direct ratio to the population of two cities, and in inverse ratio to the distance between two cities according to the statistics. So we can figure out the market share by taking the population as M_1 , M_2 and the distance as d into the gravity formula. Just as the Table 1.

Table 1 The market share figured by the population of cities in 2011 as the index

City	Population (ten	Distance away from	Gravity index	Market share
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	thousand people)	Shijiazhuang(kilometer)	F	W (%)
Beijing	2018	283	25.60	18.30
Tianjin	1294	387	8.78	6.28
Taiyuan	423	231	8.05	5.76
Zhengzhou	862	412	5.16	3.69
Jinan	681	298	7.79	5.58
Baoding	1119	131	66.25	47.43
Dezhou	576	180	18.06	12.93

* Note: M_i represents the population of Shijiazhuang area in 2011 which is 1.016 million.

2.2.2. Establishing the Gravity Model According to GDP as the Main Factor

The wealth of the city will influence directly on the tourist consuming ability. The richer the city is, the more contribution it will make to the tourism market of the target city. We can figure out the market share by taking GDP as M_1 , M_2 and the distance as d into the gravity formula. Just as the Table 2

Table 2 the market share figured out by GDP in 2011 as the index

City	GDP (hundred million Yuan)	Distance away from Shijiazhuang (kilometer)	Gravity index F	Market share W (%)
Beijing	16223	283	689	34.76
Tianjin	11192	387	254	12.82
Taiyuan	2085	231	133	6.71
Zhengzhou	4909	412	98	4.94
Jinan	3331	298	128	6.45
Baoding	2400	131	475	23.97
Dezhou	1951	180	205	10.34

* Note: M_i represents the GDP of Shijiazhuang area in 2011 which is 3401 hundred million Yuan.

2.2.3. Establishing the Gravity Model According to Average Per Capita Income of the Town as the Main Factor

The income level influences on the tourism consuming ability greatly and different income groups have different requirements for the natural environment, the human environment, the traveling connotation, the traveling time and the traveling cost of the scenic spots. We can figure out the market share by taking the average per capita income of the town into the gravity formula. Just as the Table 3.

Table 3 the market share figured out by the average per capita income of the town in 2011 as the index

City	Average per capita yearly income (Yuan)	Distance away from Shijiazhuang (kilometer)	Gravity index F	Market share W (%)
Beijing	80394	283	33589	17.65
Tianjin	86496	387	19325	10.16
Taiyuan	49292	231	30910	16.24
Zhengzhou	56949	412	11226	5.90

Jinan	48927	298	18436	9069
Baoding	21447	131	41819	21.98
Dezhou	33866	180	34976	18.38

*Note: M_i represents the average per capita income of Shijiazhuang area in 2011 which is 33462 Yuan.

2.3. Analysis of the Result According to the Gravity Model and Suggestions

Comparing the calculation results of the gravity model and reality, it is not difficult to find the contradiction: Jinan itself as a prestigious tourist city, its visitor's interest in the provincial capital Shijiazhuang, went so far as not as good as Texas, Taiyuan tourists. The share of Tianjin in the gravity model of Shijiazhuang is small. As a result of the exist of these special cases, we make the following recommendations of further development of tourism in Shijiazhuang:

The emphasis of creating "the scenic spots for leisure and vacation" is the environment including natural environment and human environment. The natural environment is the most important for the leisure vacation tour. Shijiazhuang with mountains, rivers and fresh air is richly endowed by nature to develop, so we believe there will be a fast development stage if we have the right direction, proper advertisement, and leisure health characteristic.

Next we will analyze and evaluate the natural environment of Shijiazhuang from the perspective of "anion", and propose the improvement suggestions.

3. The Test and Evaluation of Air Anion Concentration in the Sceneries of Shijiazhuang.

3.1. Relationship between the air anion concentration and human health

The charged particle formed after atom loses or obtains the electron is the ion, and the charged atomic group is also called as "the ion". Under some special circumstances, some molecules also may form the ion. The "anion" is the ion with one or some negative charge, and it also can be called as "anion". The higher the air anion concentration, the better the air quality is. The air that contains more anion have some benefits to debase high blood pressure, asthma, influenza, insomnia, arthritis, burns and other treatment, can prevent from the development of rickets and scurvy, can improve the ventilation function of lung, promote metabolism, enhance the inhibition of the cerebral cortex, adjust the function of cerebral cortex; and can improve our sleep, our immune system and the quality of life.

3.2. The evaluation standards of air anion concentration in the air

According to the measuring of air anion concentration in Beidaihe, Qinghuangdao, Dalian, Lvshunkou, Huayuankou and other coastal areas, and the long-term study of the materials that release anion, Professor Li put forward seven evaluation criteria system of air anion concentration, and evaluated the air anion concentration of Dalian by the criteria system. This indicated that the relationship of the content of anion and human health.

3.3. The menstruation and discussion of air anion concentration

The air anion concentration was the number of anion per each unit volume, and its unit is ions/cm³. The testing team of Yanshan University tested and studied the air anion concentration in some scenic spots of Xibaipo, Zhangshiyuan, Wuyuezhai, Mount Cangyan and Tangshan sea world on July 1st and 2nd, 2012. It was the first time that systematically tested the air anion concentration in five sceneries of Shijiazhuang, Hebei.

Testing instruments: DLY-6A-232 and DLY-4G-232 type air anion concentration testing instrument of Shijiazhuang, China.

3.4. Results and discussion

Test results of all test points are shown in Table 4.

Table 4 the air anion concentration of each scenic spots in Shijiazhuang

Testing site	Average (ions/cm ³)	maximum (ions/cm ³)	minimum (ions/cm ³)	Testing time (s)
Zhangshiyuan	9667	10750	6940	180
Mount Cangyan	7833	8360	6280	180
Wuyuezhai	11847	12410	8270	180
Tianshan sea world	1955	1720	2160	180
Xibaipo	1637	1820	1510	180
Cha River	1254	1390	1020	180
Lotus Pond	1627	1780	1520	180
Longxing Temple	1310	1420	1180	180
Nangaoji Park	1422	1530	1290	180
Huangbizhuang Reservoir	1511	1670	1310	180

Then according to the seven levels standard evaluation system, that proposed by Professor Qingshan Li of Yanshan University, the team evaluated the air anion concentration of these scenic spots, and the level showed in the table below.

The two tables above showed that the air anion concentration in majority of scenic spots in Shijiazhuang reached the 3rd and higher grade, the average grade of Tianshan sea world, Xibaipo, Lotus Pond and Nangaoji Park reached 2nd grade, and some spots reached superfine and super grade. This indicated that the air quality of these spots were very good, the air was fair fresh. When people were in this ambiance, this not only made them feel refreshed, but also released fatigue, prevent us from diseases and so on. Therefore, having a trip to the scenery with high air anion concentration, when the urbanite are free, people can not only exercise their body, but also be free from diseases, and the level of the whole society's health also improves.

The tested data of Longxing Temple was shown in Fig.1 as follow

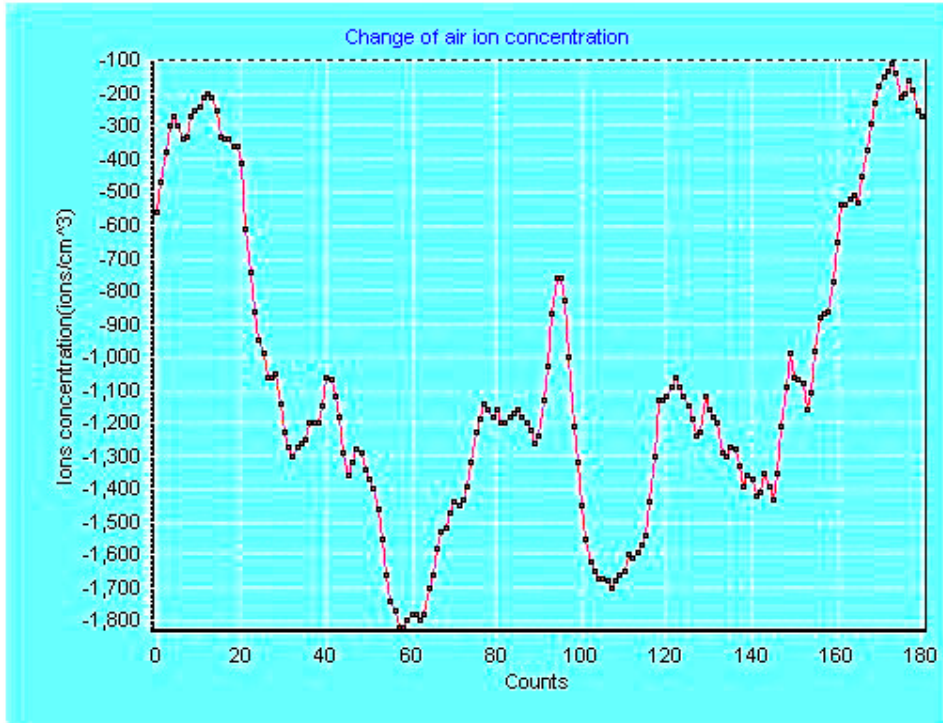


Fig.1 the air anion concentration tested in Longxing Temple

4. Conclusion and Suggestions

The results, which were tested by the testing team by graduates majoring in Polymer material, showed that the grade of most sceneries in Shijiazhuang can reach the 3rd grade or higher, the average grade of Tangshan sea world, Xibaipo, Lotus Pond and Nangaoji Park reached 2nd grade, and some spots reached superfine and super grade, the air quality there was very good, So the development of the natural environment is the trump card for the tourism market of Shijiazhuang.

We can know the potential of the surrounding market development in Shijiazhuang is great from the calculation of gravity model, so we suggest developing the natural environment of Shijiazhuang by building some supporting facilities for “negative ion” ecological tourism. These supporting facilities include: 1. Building the water-loving environment such as fountains and artificial waterfalls. 2. Enlarging the area of the green vegetation such as trees and grasslands. 3. Choosing the negative ion building materials and painting the negative ion dope.

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