# Suggestions on Strengthening Greening Construction of Ecological Residential Areas

**Peng LI***

Pingdingshan Universty, Pingdingshan 467000, China

**Abstract** Greening construction is an important part of the construction of ecological residential areas, but there exist some misunderstandings in greening construction of ecological residential districts at present. Based on the description of functions of green space in ecological residential areas, the summarization of principles of greening design, and the discussion of questions in greening construction of ecological residential districts, some suggestions as well as specific measures for strengthening greening construction of ecological residential areas were proposed to promote the healthy development of greening construction in ecological residential areas.

**Key words** Ecological residential community, Greening construction, Suggestions, Measures

Greening construction of a residential area can create an interesting living environment, and it is an important symbol of urban environmental quality, so greening level of a residential community can reflect people's living environment in quality and is closely related to human quality of life. Moreover, greening construction of residential areas is an important part of urban landscaping and a key step in improving urban ecological environment[1-3]. As social progress and improvement of people's living level, people's demand for high-quality residential buildings and environment has increased day by day. How to create a beautiful living environment through greening is essential for construction of residential areas. To cater for consumers' psychological need for getting close to nature, many real estate developers claim that their buildings are ecological residential areas. An ecological residential area means that based on advanced technology of contemporary architecture, ecology and other fields, a residential district is regarded an ecosystem where material and energy cycle and transformation are orderly and coordinate with natural ecosystem, so as to create a efficient and clean living environment[4-5]. In addition, construction of an ecological city will be the weather vane of urban sustainable development, and an ecological residential district is a basic element of an ecological city. Construction of an ecological residential area is carried out through protecting ecological environment of a residential area, building successive and complete green space system, creating conditions for biodiversity of a residential district, valuing landform of a residential area and so forth[6-9].

## 1 Functions of green space in ecological residential areas

**1.1 Improving ecological environment** At present, people make a residential district green by planting trees, flowers, *etc.*, and these plants have great effects on light, temperature, humidity, air and other ecological factors of the environment. It is generally known that plants can absorb $CO_2$ and release $O_2$ through photosynthesis to make their content in the atmosphere stable. With the acceleration of industrialization process, $CO_2$ concentration in the atmosphere has increased continuously, and greenhouse effect has shown gradually, so planting green plants in urban residential districts is of great significance to air purification. For instance, plants can transport water vapor to air through transpiration, and heat in the environment can be taken away during the transformation of liquid water into water vapor to decrease ambient temperature, which has positive effects on the improvement of microclimate. Meanwhile, plant leaves can absorb dust and toxic gases in the air to purify the air of a residential area[10]. Besides, green plants can also decrease noise, because large quantities of micropores and dense fuzz on surface of plant stems and leaves can weaken sound wave transfer or make it change direction and refract it. Moreover, a green belt composed of arbor, shrub and herb can insulate against sound. Moreover, plants can make people in the shade, adjust air temperature and lower wind speed, and the effects are more obvious in hot summer[5].

**1.2 Providing a leisure activity place** Residents often exercise and chat with each other in central green space of a residential district, because there are many facilities for leisure activities. Outdoor activities in the green space can make residents acquaint with each other, promote mutual friendship.

**1.3 Creating landscape and cultural atmosphere** Through rational allocation of plants for promoting parting of garden space and suitable arrangement of sculptures in a residential area, residents in the residential area can have a landscape and cultural atmosphere. Using plant landscaping techniques, the appearance, structure and level of trees, shrubs, vines and herbs are processed to form a distinctive landscape. The combination of plants, building products and water can not only beautify residential areas, but

Received: January 26, 2012 Accepted: June 7, 2013
Supported by the Key Research Project of Pingdingshan City (SKL-2011-336).
* Corresponding author. E-mail: pdsxylp@163.com

also make the buildings more lively[11].

**1.4 Health care** Urban residents living in a residential district with green environment are far from the noises of cities, feel relief and enjoy themselves. Moreover, they will feel comfort and relax after breathing dense natural flavor of plant branches, leaves, flowers and fruit[12]. In addition, buds, leaves and pollen of green plants can secrete volatile substances than can kill bacterium, fungi and protists in the atmosphere, which has positive significance to the reduction of disease spread.

**1.5 Disaster prevention** In a residential district, residents can move to green spaces when a disaster happens suddenly. For instance, when a variety of buildings collapse and secondary disasters happen continuously after an earthquake occurs, residents are evacuated to a clearing to reduce quantity of casualties, so green spaces in urban residential districts are ideal places for people to escape disasters[13-15]. Moreover, there is lots of water in leaves of many green plants, so they can prevent fire from spreading and reduce occurrence of secondary disasters.

## 2 Design principles of ecological residential district greening

As the enhancement of people's environmental awareness and improvement of people's environmental demand day by day, more and more house purchasers pay more attention to landscape environment, and residential district greening is important to people. To improve urban microclimate and give full play to residential districts, residential district greening aims to make residential districts convenient, safe, clean, environmentally friendly and create a comfortable, beautiful, healthy and vibrant ecological landscape[16]. When designing modern ecological residential districts, we demand that the greening rate should reach 30%, and it is up to 50% -60% for upscale residential districts[17].

**2.1 Planting suitable trees according to local conditions** During the greening construction of ecological residential districts, we should plant suitable trees according to local conditions and plant characteristics to make plants show morphological characters in different seasons[18]. Besides, we should make full use of original landform and reserve original plants to reduce investment and maintenance cost[19]. In addition, native plants and some foreign plants with strong adaptability and high ornamental value can be planted to improve planting structure of a residential district[20-22].

**2.2 Plant landscaping** All kinds of ornamental flowers and plants are key elements of landscape design, and they can not only improve ecological environment and decorate people's lives, but also enhance people's awareness to beautify the environment[23]. Planting trees can not only obtain optimal environmental benefit and visual effect, but also get social and economic benefit. However, many lifeless pavilions and rockeries can be found in green spaces of many residential districts instead of plants, so that the proportion of soft landscape to hard landscape unbalances increasingly. Moreover, pursuing hard landscape unilaterally conceals natural environment and cozy residential atmosphere expected by people[24-26].

**2.3 Producing a harmony of greening and buildings** During the greening of an ecological residential zone, each garden element should be in harmony with building style and residential environment according to people's aesthetic demand[18,20]. In fact, all kinds of garden elements are quite different in style, so that residential environment becomes disorderly and unsystematic and has adverse effects on residents' body and mind.

**2.4 Combining practicality and artistic quality** Different from park design, ecological residential zone greening should combine practicality and artistic quality to plants trees according to plant characters. In addition, it should aim to produce a harmony of change and unity in respect of plant arrangement. Modern people's emotional and cultural taste is orientated towards ecological residential environment, so we should consider humanistic connotation to create a fun living space[27]. Therefore, when designing the greening plan of ecological residential zones, designers should fully consider residents' demand for physical exercise and entertainment. In a word, ecological residential zone greening concerns all residents' quality of life, so designers ought to innovate the greening and design a humane, ecological and natural garden landscape.

**2.5 Scientifically arranging plant communities to make full use of plant functions** In modern residential zones, plant communities are the base of green spaces, so we should plant trees, shrubs, herbaceous flowers and liana to form rational green landscape according to their species and habits. According to a previous study, the optimal plating model of plants in a city is composed of trees, shrubs and grasses[28], which can not only save land but also obtain optimal ecological benefit. Besides, we ought to plant trees and flowers in green spaces of a residential district according to functions of plants. For example, trees with high branching points, straight trunks, few pests and resistance to cutting should be planted on both sides of roads in residential districts. Trees with low branching points and strong germination capacity can be used as green fences; to make window sills, balconies, walls and roofs green, we must choose plants that can prevent dust, evaporation and pollution[17].

## 3 Problems in the greening construction of ecological residential zones

**3.1 Unreasonable plant arrangement** Flowers and grasses can be found everywhere in each ecological residential district, but most districts have an excellent landscape in spring, but it is monotonous in other seasons. In some residential zones built from the 1980s to 1990s, normal growth of plants has been affected due to small row spacing. Moreover, to pursue commercial effect, developers have planted large quantities of big seedlings, but these seedlings are accustomed to native environment, so it is difficult to survive. Besides, developers are keen to plant popular species, so that many good native species can not be planted and have to exit their original habitats.

**3.2 Monotonous greening design** Considerable residents living in an ecological residential district find that there are similar plants in their residential environment, so that it is difficult for visitors to distinguish and find their districts. In many green spaces, there are lawns ornamented with cycads, Rhododendron pulchrum or Juniperus formosana, and edged with Berberis thunbergii cv. atropurpurea. Therefore, developers ought to pay more attention to the difference in greening environment to give buildings individuality.

**3.3 Placing much emphasis on lawns and neglecting plant communities** At present, large area of lawns can be found in many ecological residential zones, but there are few trees. It is unscientific to only plant grasses in residential zones, because a lawn has weak practicality and high cost, which will increase residents' property fees. There are no trees affording us shade in some residential districts. Moreover, residents are not allowed to enter lawns in most residential zones.

**3.4 Lacking management and maintenance** In almost all residential districts, construction waste like cement and line still accumulate under soil with thickness of 5 – 10 cm, which will result in soil leakage or induration and obvious increase of soil pH. After many residential zones are put into use, the greening environment has suffered various degrees of damage due to negligence of management and maintenance, so that greening level of these residential zones can not achieve the desired level.

## 4 Suggestions and measures for strengthening greening construction of ecological residential areas

**4.1 Rational layout of green spaces** Green spaces in residential districts can be grouped into central green space, special green space, green spaces on a road or in a courtyard, and their functions are distinct. When designing greening landscape, designers should center on major green spaces as well as green spaces on a road or in a courtyard to rationally arrange green spaces according to overall style of a residential zone. In addition, business services, cultural characteristics and property management should also be considered. Moreover, the layout of green spaces and buildings in an ecological residential zone should be carried out synchronously. Besides, the planning of an ecological residential zone should give priority to open space to coordinate green spaces, buildings and roads[29-30]. Greening rate of a residential district should reach above 35%, and that of green spaces should be higher than 70%, that is, hard landscape of green spaces should account for no more than 30%. Moreover, the style, form and layout of green spaces and buildings should be in co – ordination with each other.

**4.2 Reasonably choosing plants for green spaces** Choice of plant species is a direct factor in the success of greening. Plants including trees, shrubs, flowers, grasses, liana and aquatic plants are the basic element of greening landscape, and choice of plant species for green spaces should be conducted according to their ecological characters, color, flowering and fruiting period and layout demand of a district[31]. Additionally, plant with strong resistance to diseases and pests should be chosen to reduce chemical pollution source caused by pesticides; innoxious plants without thorns have priority, because they are safe for children[32]. Besides, plants with flowers and fruits should be planted, because they can attract bees and butterflies to increase biodiversity of the ecological community. People can build some nests in trees to attract birds, and birds can prey on insects to realize biological control of pests. Presently, considerable cities have suffered serious environmental pollution, so plants with strong resistance to environmental pollution should be planted in a residential district.

**4.3 Rational arrangement of plants** In ecological residential zones, arrangement of plants should be conducted to simulate natural ecological environment according to physiological and ecological characteristics as well as aesthetic principle of a garden, and a multilayer structure should be created as much as possible to keep plant communities stable and lasting in space and time[17]. In addition, trees, shrubs and cover plants should be planted together to form a multilayer structure[28]. Meanwhile, arrangement of plants should be changed with seasons to create distinct landscapes in the seasons. Additionally, plant species and cultivating forms should vary with green spaces. That is, trees with a wide tree crown and good shading effect can be planted on either side of a road in a row, while other forms like bunch and massive planting can be adopted in other green spaces.

**4.4 Giving priority to native plants according to local conditions** Based on natural topography and current conditions of an ecological residential district, inferior land, sloping fields, depressions and water surfaces should be used as green spaces to in the district. Original trees should be incorporated into new garden landscape and overall environment. Physiological, genetic and morphological characteristics of native plants are accommodated to local natural conditions, and these plants have strong vitality and resistance to diseases and pests and low maintenance cost, so they should be given priority[33]. Moreover, most native plants have high planting preservation rate and excellent rate and can reflect local vegetation landscape[34]. However, tropical plants are planted in many newly-built residential districts of North China to improve grade of these districts, but the cost of introduction and maintenance is enormous, and these tropical plants may die because they do not adapt to local climate.

**4.5 Putting emphasis on user-friendly design** In a residential zone, plant landscape should be designed according to people's needs, so greening plan of an ecological residential district should place emphasis on user-friendly design[35]. People like green spaces because they can chat with each other, take a walk and do exercises in the shade of trees. In addition, lawns should be resistant to trampling, and a pebble road should be paved. Meanwhile, some recreational facilities should be set up for children in green spaces to fully embody user-friendly design[36].

**4.6 Advocating three-dimensional greening** To make an ecological residential district green, trees, shrubs and herbs should

be combined to create a dimensional planting effect[37]. Additionally, it is demanded that the quantity of ornamental plant species used for greening is different in various regions. For instance, quantity of woody plant species should be not lower than 40, 50 and 60 in three northern areas of China, central and eastern China, and southern and southwestern China[29]. Compared with three-dimensional planting, large areas of lawns have higher cost of maintenance and lower ecological benefit, so three-dimensional planting should be advocated[38]. Besides, plants can be planted on a roof and balcony to form a landscape in the air. For example, a roof garden can provide a new leisure place for residents, and vegetation on the roof can decrease room temperature of buildings[39]. In addition, liana like Boston ivy and wisteria can be used to make walls green, and they can shelter walls from sunlight in summer and reduce room temperature of buildings[40-41].

**4.7 Waterscape greening** It is generally known that water is the source of life[42], and large areas of waterscapes can increase air humidity and adjust surrounding microclimate, so a waterscape is indispensable to modern residential zones. However, if there is no running water source, it is cautious to adopt waterscape greening in northern cities lacking water. At present, there is no running water supplemented to waterscapes in many districts without a water purification system, so these waterscapes have become stagnant water[43]. A system used to collect rainwater should be set up in an ecological residential zone, and the rainwater collected can be used to build waterscapes. In addition, residents' domestic water processed can be used as running water of waterscapes. Generally speaking, waterscapes should be built to the south of buildings, so that southeast wind can blow moist air over water surfaces towards buildings and surrounding environment in summer[44]. Waterscape greening means that plants are planted in water or along banks, and planting submerged plants and floating plants in water can not only beautify the environment but also purify water[45]. Besides, some wetland plants suitable for local climatic conditions can be planted along banks, and color and height collocation of plants in different seasons should be paid more attention to[46-47].

**4.8 Emphasizing practicality** High-quality natural and humanistic environment are beneficial to people's work, life and health, so garden landscapes of ecological residential districts should be combined with residents' needs, and simple and practical landscape layout should be given priority. Greening area should account for above 35% of building area, and garden landscapes should have local characteristics and ethnic style instead of western style[19,48]. Greening design of an ecological residential zone should emphasizing practicality. For instance, some harmless plants without thorns and peculiar smell should be planted in children's activity area according to their psychological and play features; some beautiful high trees with health efficacy can be planted in old people's activity area; liana should be planted in a stopping pad, and it can protect cars[49].

**4.9 Strengthening greening management** First, it is necessary to strengthen acceptance check of green spaces in an ecological residential area from the aspects of greening rate, plant species, survival rate of seedlings, construction waste under surface soil. In addition, soil transformation should be carried out in current green spaces, and soil should be changed with plants to improve their growth conditions. Water consumption of an ecological residential zone should be minimized, so a system to collect rainwater should be set up besides water-saving irrigation facilities, and the rainwater collected can be used to irrigate green spaces to save water[50]. Pruning plants and application of chemical fertilizer should be minimized, and methane tanks can be built in a district, because waste materials and fluid decomposed can be used as fertilizer of plants, and methane can be used as clean and green energy for public lighting[51]. A survey on plant species of an ecological residential district should be carried out, and excessive plants flowering in spring should be reduced, while plants flowering and fruiting in summer, autumn and winter and evergreen species should be increased. In addition, coleus plants and sun plants with abnormal color of leaves and bad growth should be transplanted into sunny soil. Trees with small growth space and bad growth should be removed or cut down to increase growth space of other trees and promote uniform growth of plant communities[52].

**4.10 Setting up a greening file of a residential district** Each ecological residential zone should have a green file with content of construction, examining and receiving notes and planar maps of green spaces, green management record and so forth. In addition, greening files of ecological residential districts should be integrated into urban greening construction files, so that greening administrative departments can know dynamic variation of each ecological residential zone in greening construction[53]. In a word, greening construction of an ecological residential area is a systematic engineering composed of planning and design, plant choice, greening construction, maintenance and management, it aims to use the least resources to create the most ecological benefit and provide good living environment for residents[54].

## References

[1] WANG RL, SONG CY. Development review on green ecological residential district[J]. Journal of Chongqing University of Science and Technology (Social Sciences Edition), 2011(2): 97-98, 120. (in Chinese).

[2] WU SF, LAN CY. Discussion on the basic elements of building ecological district[J]. Shanxi Architecture, 2010, 36(11): 61-62. (in Chinese).

[3] JING XR, ZHANG J, LIN Y. Development and build of green ecological residential guarter[J]. Journal of Chongqing University (Natural Science Edition), 2003, 26(6): 105-108. (in Chinese).

[4] YU B. The building of many kinds of aulophyte in ecodistricts—Superficial analysis of green environment construction in Yiquan Villa of Conghua [J]. Guangdong Building Materials, 2006(9): 153. (in Chinese).

[5] LIU W. Ecological function and problems and countermeasures on construction of urban greenbelt system[J]. Chinese Journal of Environmental Management, 2002(2): 32-34. (in Chinese).

[6] ZHOU T, LI QM. The analysis of the development of green residential quarters in China[J]. Construction Management Modernization, 2002(1): 47-49. (in Chinese).

[7] HUANG GY, CHEN Y. Discussion on urban ecologization and ecological city [J]. Urban Environment & Urban Ecology, 1999, 12(6): 28-31. (in Chi-

nese).
[8] SU ZQ, XU HX, ZENG ZY, *et al*. The construction of ecological city for ecological civilization [J]. Urban Environment & Urban Ecology, 2001, 14(3): 27 – 29. (in Chinese).
[9] ZHU DQ, DING J, YU GL. Superficial analysis of eco-areola and its planning [J]. Journal of Jianxi Agricultural University (Social Sciences Edition), 2003, 2(3): 61 – 62. (in Chinese).
[10] QIU JY. Try to talk about greenbelt ecological construction in town residential area[J]. Science & Technology Information, 2006(23): 137. (in Chinese).
[11] LU LM. Superficial analysis on the planning and design of urban ecodistricts[J]. Science and Technology Innovation Herald, 2011(5): 223. (in Chinese).
[12] CAO ZP. Sustainable management of ecological environment—Indicator system and research progress [M]. Beijing: China Environmental Science Press, 1999. (in Chinese).
[13] SU Q, QIAN XQ. Key points on planning and designing of city shelter[J]. Journal of Suzhou University, 2007, 27(4): 66 – 69. (in Chinese).
[14] BAO ZY, CHEN B. Construction of urban green space system and reduction and prevention of urban disaster[J]. Journal of Natural Disasters, 2004, 13(2): 155 – 160. (in Chinese).
[15] HONG JX, CUI YJ. Urban garden greening and earthquake resistance and disaster prevention—The reflections on greening effect and construction after Tangshan earthquake [J]. Chinese Landscape Architecture, 1999, 15(3): 57 – 58. (in Chinese).
[16] NA YW. Superficial analysis on greening design of urban residential districts [J]. Modern Horticulture, 2011(9): 147, 158. (in Chinese).
[17] XU ZH. Superficial analysis on the choice and configuration of greening plant in dwelling districts[J]. Flowers Trees Potted Landscape( Flowers and Horticulture), 2006(8): 46 – 50. (in Chinese).
[18] HE S, ZHENG MY. Greening design of Guangzhou residential area[J]. Guangdong Agricultural Sciences, 2011, 38(16): 139 – 143. (in Chinese).
[19] CHEN ZQ. Discussion on the quality of environmental greening in Guangzhou dwelling districts[J]. Tropical Geography, 2005, 25(3): 243 – 247. (in Chinese).
[20] LU P. The harmonious coexistence between man and nature—The reflections on garden design of residential districts at present [J]. Anhui Agricultural Science Bulletin, 2007, 13(13): 84 – 85. (in Chinese).
[21] YING QS, DING HJ. Studies on application of native tree species to my city afforeststion[J]. Chinese Landscape Architecture, 2003, 19(7): 63 – 65. (in Chinese).
[22] FU L, SHEN SY. The application of indigenous plant in urban gardening landscape construction of regional cities [J]. Modern Agricultural Science and Technology, 2009(2): 66 – 67, 70. (in Chinese).
[23] LIU JS. Superficial analysis on landscape planning and design ideas based on plant landscape[J]. Guangdong Science & Technology, 2007(7): 191 – 192. (in Chinese).
[24] QIU CH. Try to talk about the function of plant landscape in residential districts that will be realized[J]. Southern Publication, 2005(10): 53 – 54. (in Chinese).
[25] BI Y, FAN GC. Study on plant diversity of greening in residential areas in Kunming[J]. Inner Mongolia Forestry Investigation and Design, 2006, 29(1): 35 – 38. (in Chinese).
[26] LI JX. Simple analysis on the greening design of the urban residential block [J]. Tianjin Agricultural Sciences, 2011, 17(3): 127 – 129. (in Chinese).
[27] FU MJ. Landscape planning from the view of scientific and ecological landscape architecture [J]. Science and Technology Innovation Herald, 2010(21): 143. (in Chinese).
[28] FAN ZY. Superficial analysis on the greening of Tiantie residential districts [J]. Resources Economization & Environment Protection, 2009(5): 46 – 47. (in Chinese).
[29] Housing Industilization Promoting Centre of Minist. Outlines and technical principles for green ecological residential quarter construction[J]. Housing Science, 2001(6): 3 – 10. (in Chinese).
[30] CHENG XK. Building ecological concept and flourishing residential market [J]. Garden, 2002(1): 18. (in Chinese).
[31] ZHOU Z. Study on outdoor environment design of urban community[D]. Tianjin: Tianjin University, 2006. (in Chinese).
[32] YU J, LI RQ. Superficial analysis of greening design of residential quarter [J]. Northern Horticulture, 2006(2): 85. (in Chinese).
[33] WU ZM, XIANG GH, GU ZH. Popularization and application of native plants for urban landscaping in the city of Changde[J]. Hubei Agricultural Sciences, 2011, 50(11): 2269 – 2271. (in Chinese).
[34] TIAN F, ZOU ZR, YANG NJ. Research on the application of local trees resources in City of Luoyang[J]. Journal of Anhui Agricultural Sciences, 2009, 37(19): 9222 – 9223, 9233. (in Chinese).
[35] ZHAO LY, WANG YN. Study on the humanized design of landscape green area in residential district[J]. Journal of Anhui Agricultural Sciences, 2009, 37(5): 1979 – 1981. (in Chinese).
[36] WU LY. Introduction of humanist settlement environment science[M]. Beijing: China Architecture and Building Press, 2001. (in Chinese).
[37] HAN SQ. Vertical planting and low-carbon lifestyle[J]. Northern Horticulture, 2010 (18): 128 – 129. (in Chinese).
[38] WANG LJ, JIANG YF. The reflections on greening design for ecodistrict [J]. Building Science Research of Sichuan, 2009, 35(4): 212 – 213. (in Chinese).
[39] YANG NM, XIE YJ. Discussion on the function of green roofs in ecological areas[J] Water & Wastewater Engineering, 22009, 35(Supplement): 363 – 365. (in Chinese).
[40] ZHANG Y, SUN LY, WANG YG, *et al*. The application of vertical planting in urbanization construction [J]. Henan Science & Technology, 2010(9): 83. (in Chinese).
[41] ZHU XF. From the perspective of ecological landscape greening the city a new form of three-dimensional landscape[D]. Tianjin: Hebei University of Technology, 2010. (in Chinese).
[42] YANG K, HUANG T, DONG YK, *et al*. Initial analysis on water landscape ecological design of living district[J]. Northern Horticulture, 2011(2): 122 – 124. (in Chinese).
[43] LUO J. The planning and design of waterscape in modern living enviironment [D]. Tianjin: Tianjin University, 2003. (in Chinese).
[44] ZHANG HM, DENG FT, SUN XS. Brief talk on ecological design of manmade waterscape in residential area[J]. Environmental Science Survey, 2009, 28(5): 11 – 14. (in Chinese).
[45] NIE MS, REN H, LI J. The planning of water environment system of ecological residential areas[J]. Water & Wastewater Engineering, 2004, 30(1): 60 – 63. (in Chinese).
[46] CAO WB. Superficial analysis of planning and design of ecological residential areas [J]. Sichuan Architecture, 2009(6): 66 – 67. (in Chinese).
[47] FENG W, DAI P. The waterscape design ideas of ecological residential areas [J]. Sichuan Architecture, 2008, 28(4): 18 – 19. (in Chinese).
[48] CHU CJ, WANG GB, LIU JC. Discussion on some issues about configuration of greening plans in residential areas of Pingdingshan City[J]. Heilongjiang Agricultural Sciences, 2009(3): 96 – 97. (in Chinese).
[49] WANG RS. Efficiency and harmony—Urban ecological control principle and methods [M]. Changsha: Hunan Education Press, 1988. (in Chinese).
[50] TIAN W. Design of residential rainwater reuse[J]. Journal of Agricultural Mechanization Research, 2010, 32(9): 227 – 230. (in Chinese).
[51] ZHONG HB, FENG JH. Superficial analysis of green planting design and maintenance management of Haikou residential quarter[J]. Tropical Forestry, 2005, 33(4): 39 – 41. (in Chinese).
[52] ZHONG ZP. Landscaping and the importance of conservation and management——On the problems and countermeasures of Central South City residential area afforestation and conservation[J]. Hunnan Agricultural Machinery, 2012(3): 212 – 213. (in Chinese).
[53] ZHANG PH, LIU XD. Supervision of managerial archives for residential quarters[J]. Engineering and Construction, 2007, 21(4): 655 – 656. (in Chinese).
[54] XIE T, XU JC, SHI K, *et al*. Discussion on environmental property and index system of ecological district[J]. Sichuan Environment, 2003, 22(4): 1 – 3. (in Chinese).